SNAP PAC S-SERIES CONTROLLER USER'S GUIDE

SNAP-PAC-S1
SNAP-PAC-S2
SNAP-PAC-S1-FM
SNAP-PAC-S1-W
SNAP-PAC-S2-W

Form 1592-091209—December 2009

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SNAP PAC S-Series User's Guide
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Table of Contents

Chapter 1: Overview 1

Introduction 1
Ethernet Communication 1
Wired+Wireless™ Communication 2
Serial Communication 3
I/O Unit Compatibility 3
Software 4
Software Availability 5
Architectural Diagrams 5
Basic Control System 6
Segmented Wired Networks 7
Wired and Wireless Networks 8
Connections to Legacy Serial-based I/O Units 9
SNAP-PAC-S2 Connections to Serial-based I/O Units 10
Ethernet Link Redundancy 11
Remote Host and I/O Unit Connections Using PPP 12
About This Guide 13
Related Documentation 13
For Help 14

Chapter 2: Quick Start 15

Installing and Configuring the Controller 15
What You Will Need 15
Installing Software 15
Power Supply Recommendations 16
Change to SNAP-PAC-S1 Power Input Range 16
Installing Hardware 16

RS-232 and RS-485 Serial Networking 18
RS-232 Connections 18
Attaching a Modem to the Controller 18
RS-485 Connections 18
Wiring the 10-pin Serial Connector on SNAP-PAC-S1 Controllers 19
Wiring the 7-pin Serial Connector on SNAP-PAC-S2 Controllers 20
Serial Wiring Diagrams 21
Assigning an IP Address 24
Assigning Serial Ports on SNAP-PAC-S2 Controllers 24
Mounting the Controller 25
Panel Mounting and Dimensions 25
DIN-Rail Mounting and Dimensions 29
About the Controller's Memory Map 31
Using Data for Peer-to-Peer Communication 31
What's Next? 32

Chapter 3: Maintenance and Troubleshooting 33

Troubleshooting 33
Checking Power 33
Communicating on a Wired Ethernet Network 34
Pinging the Controller 34
Solving Network Problems 35
Create a Network Diagram 35
Check Ethernet Errors 35
Analyze Communication Packets 36
Have Your Network Certified 36
TCP Settings 36
Communicating on a Serial Network 38
Maintaining the Controller 39
Backup Battery 39
Getting Device and Firmware Information 39
Changing the Controller's IP Address 40
Resetting the Controller 40
Loading New Firmware 41
Using the MicroSD Card 41
Card Type and Format 42
Storing and Accessing Data or Files 42
Displaying Free Space on the Card 43

Updating Firmware 43
Booting from Firmware on the Card 45
Updating, Running, or Testing a Strategy 46
Disabling or Enabling Firmware and Strategy Updates Via the Card 48
Setting Time and Date 48
STAT LED Blink Codes 48
Serial Port LEDs 50
WLAN LED (Wired+Wireless Models Only) 50

Appendix A: Technical Specifications 51

Specifications 51
SNAP-PAC-S1 and -FM Connectors, Indicators, and Pinouts 53
SNAP-PAC-S1-W Connectors and Indicators (Wired+Wireless) 54
SNAP-PAC-S2 Connectors, Indicators, and Pinouts 55
SNAP-PAC-S2-W Connectors and Indicators (Wired+Wireless) 56

Appendix B: PPP Support in Microsoft Windows 57

Configuring PPP Support in Microsoft Windows 57
Configuring Microsoft Windows Dial-up Networking on Windows XP 57
Configuring Microsoft Windows Dial-up Networking on Windows NT 60
Configuring Microsoft Windows Dial-up Networking on Windows 2000 61
Setting Up a Remote Access Server on the PC (Windows 2000 Advanced Server) 64
Setting Up a Remote Access Server on the PC (Windows NT) 67

Index 69

1: Overview

Introduction

SNAP-PAC-S2 controller

The SNAP PAC S-series programmable automation controllers provide powerful, real-time control and communication to meet your industrial control, monitoring, and data acquisition needs. As part of the Opto 22 SNAP PAC System, one of these compact, industrially hardened controllers can handle multiple control, automation, and data acquisition tasks involving digital and analog control, serial string handling, PID, and enterprise connectivity.

Connecting to Opto 22 serial- and Ethernet-based I/O systems, a SNAP PAC S-series controller runs control programs written in Opto 22's PAC Control™ software to monitor and control a wide range of devices and equipment. SNAP PAC S-series controllers are well suited to original equipment manufacturers (OEMs), system integrators, and end-users in process control, discrete manufacturing, or hybrid industries and applications.

A SNAP PAC S-series controller simultaneously runs up to 32 PAC Control flowcharts, although a PAC Control strategy can actually contain a much larger number of flowcharts. The total number of flowcharts is limited only by the controller memory available for strategy storage.

Ethernet Communication

All SNAP PAC S-series programmable controllers communicate over standard 10/100 Mbps Ethernet networks and can be attached to existing wired or wireless Ethernet networks. The controllers can also be used in an independent control network built with standard, off-the-shelf Ethernet hardware.

SNAP PAC S-series controllers include two 10/100 Mbps Ethernet interfaces for networking through an Ethernet switch to Ethernet hosts, as well as SNAP PAC brains and I/O, which provide local intelligence and the connections to digital and analog sensors and actuators as well as serial devices.

These independent Ethernet ports have separate IP addresses that can be used with PAC Project™ Professional software to set up redundant network links to safeguard the availability and reliability of an I/O system, or to segment a control system's network from the enterprise LAN.

Supported protocols over Ethernet include EtherNet/IP™, Modbus®/TCP, SMTP, SNMP, FTP, and OptoMMP.

- Using EtherNet/IP, SNAP PAC S-series controllers can share data with Allen-Bradley® Logix PLCs and other PLC systems based on the EtherNet/IP protocol.
- Using Modbus/TCP, S-series PACs can share data with Ethernet-based Modbus hardware and software.
- SMTP (Simple Mail Transfer Protocol) is used for email, and SNMP (Simple Network Management Protocol) lets the network monitor the PAC just as it would monitor network computer hardware.
- FTP can be used to manipulate files and data in the PAC's file system.
- OptoMMP is an open, documented protocol used by all Opto 22 Ethernet-based controllers and brains.

Wired+Wireless™ Communication

SNAP-PAC-S1-W and **SNAP-PAC-S2-W** controllers add wireless capability to communications. In addition to the two wired network interfaces, these models have a wireless network interface as well, so each PAC has a total of three separate IP addresses—two wired and one wireless. Wired+Wireless PACs can be used wirelessly or on a wired network, or both at once.

For flexibility in designing your wireless network, wireless communication includes support for 802.11a, b, and g standards. Wired+Wireless PACs can be used with a variety of wireless switches and other infrastructure hardware. For the best security, the 802.11i WPA2/AES standard is supported, while older WPA and WEP security standards are included for backwards compatibility.

Just like a laptop computer with a wireless connection, all functionality remains the same whether the Wired+Wireless PAC is used wirelessly or as part of a wired network. Supported protocols remain the same. Control programs run the same on both networks without reprogramming.

A Wired+Wireless S-series PAC can communicate with both wired and wireless SNAP PAC I/O units. (See "I/O Units Supported" on page 3 for details.) If desired, the PAC can segment a wireless network from a wired one.

Serial Communication

SNAP PAC S-series controllers provide RS-232 and RS-485 communication as follows:

- The **SNAP-PAC-S1**, **SNAP-PAC-S1-FM**, and **SNAP-PAC-S1-W** have two RS-232 serial ports that support general-purpose communication with serial devices; you can send and receive data from one or two serial devices connected directly to the controller. By default, Port 0 is set to be connected to a modem using Point-to-Point Protocol (PPP) for creating TCP/IP networks over serial or PSTN (Public Switched Telephone Network) lines. To connect Port 0 to serial devices, change the port configuration in PAC Manager.

  The S1 PACs also have one pluggable two-wire RS-485 port that can be used for SNAP PAC SB-series serial brains and legacy Opto 22 *mistic*™ I/O units, including the serial B3000 brain and remote mistic bricks. The SNAP-PAC-S1-FM is Factory Mutual approved.

- The **SNAP-PAC-S2** and **SNAP-PAC-S2-W** have four serial ports that can each be configured using PAC Manager as either RS-232 or RS-485 (2-wire or 4-wire). These ports can be used for either I/O or general-purpose serial communication. Configured as RS-232, the ports support remote serial device communication, and any one of the ports can be configured as a PPP modem connection. Configured as RS-485, the serial ports connect to SNAP PAC serial brains and to *mistic* I/O units.

  If you have a substantial number of serial I/O units, the PAC S2 is the controller to use. For the default configuration settings of these ports, see "Assigning Serial Ports on SNAP-PAC-S2 Controllers" on page 24.

For additional serial interfaces, you can add one or more SNAP serial communication modules on attached SNAP Ethernet-based I/O units.

I/O Unit Compatibility

The combination of Ethernet (both wired and wireless) and serial network interfaces gives SNAP PAC S-series controllers the ability to control current and many legacy Opto 22 I/O units. All S1s have one RS-485 port, and S2s can be configured with up to four.

The following table lists I/O units supported by S-series controllers:

S-Series Controller	On a Wireless LAN	On a Wired Ethernet Network	On a Serial Network
SNAP-PAC-S1 SNAP-PAC-S1-FM SNAP-PAC-S2	---none---	SNAP-PAC-R1 SNAP-PAC-R1-FM SNAP-PAC-R2 SNAP-PAC-R2-FM SNAP-PAC-EB1 SNAP-PAC-EB1-FM SNAP-PAC-EB2 SNAP-PAC-EB2-FM SNAP-UP1-ADS* SNAP-B3000-ENET* SNAP-ENET-D64* SNAP-ENET-S64* SNAP-ENET-RTC*	SNAP-PAC-SB1 SNAP-PAC-SB2 B3000* B3000-B* SNAP-BRS* B100* B200* G4D16R* G4D32RS* G4A8R*
SNAP-PAC-S1-W SNAP-PAC-S2-W	SNAP-PAC-R1-W SNAP-PAC-R2-W SNAP-PAC-EB1-W SNAP-PAC-EB2-W		

* Legacy I/O processors; not recommended for new development

This connectivity with legacy serial-based I/O systems, combined with PAC Control Professional software's ability to import control programs (or *strategies*) written in OptoControl™ software, provides a migration path to integrate older Opto 22 I/O systems into modern control hardware running on Ethernet networks.

For detailed information on updating control strategies and integrating legacy control hardware into modern systems, see the *FactoryFloor to PAC Project Migration Technical Note* (Opto 22 form 1692).

Software

SNAP PAC controllers use Opto 22's **PAC Project** Microsoft® Windows®-compatible automation software for programming, human-machine-interface (HMI) development, and OPC and database connectivity. Two versions of PAC Project are available:

- **PAC Project Basic** includes PAC Control for developing control programs, PAC Display™ for creating operator interfaces, and PAC Manager™ configuration software.
- **PAC Project Professional** adds expanded versions of PAC Control and PAC Display plus OptoOPCServer™ software for exchanging data with OPC 2.0-compliant client software applications and OptoDataLink™ for sharing SNAP PAC System data with ODBC-compliant databases.

The PAC Project software suite includes the following applications:

- **PAC Control Basic** is a graphical, flowchart-based programming tool for machine control and process applications. Using PAC Control, you create, download, and run strategies on a SNAP PAC controller. In addition to flowchart programming with subroutine capability, PAC Control includes a powerful, built-in scripting language based on C and other procedural languages. **PAC Control Professional** adds the capabilities to import OptoControl strategies, to support *mistic* I/O units, and to use a SNAP PAC controller's independent Ethernet ports to segment communication links.
- **PAC Display Basic** is an intuitive HMI package for building operator interfaces, or *projects*, for communicating with a SNAP PAC controller. PAC Display offers a full-featured HMI including alarming, trending, and a built-in library of 3,000 industrial automation graphics. **PAC Display Professional** adds the ability to import projects created in OptoDisplay, part of the Opto 22 FactoryFloor® software suite, and to use redundant communication links on SNAP PAC controllers. PAC Display Professional can also connect to Ethernet-based FactoryFloor controllers running OptoControl strategies or ioProject controllers running ioControl strategies.
- **OptoOPCServer** (PAC Project Professional only) is a fast, efficient OPC 2.0-compliant server for communicating with many Opto 22 products, including SNAP PAC controllers running PAC Control strategies, SNAP PAC brains, SNAP Ultimate controller/brains, SNAP Ethernet and SNAP Simple brains, and Ethernet-based FactoryFloor controllers running OptoControl strategies.

  Using OptoOPCServer, you can consolidate data from all these Opto 22 systems into the OPC client software of your choice, such as third-party HMI and data acquisition packages, and custom software applications you create with tools such as Visual C++®.

- **OptoDataLink** (PAC Project Professional only) transparently provides multiple connections for data exchange with popular databases such as Microsoft SQL Server, Microsoft Access, and MySQL. OptoDataLink connects your SNAP PAC System with the tools used for making business decisions, bringing realtime, accurate data to decision makers.
- **PAC Manager** is a utility application for assigning IP addresses to SNAP PAC controllers and brains, reading or changing basic controller configuration, upgrading firmware, and inspecting or testing controllers and I/O.

Software Availability

PAC Project Basic is included with SNAP PAC controllers and can also be freely download from the Opto 22 website. www.opto22.com. PAC Project Professional is available for purchase. You can also separately purchase PAC Control Professional, PAC Display Professional, OptoOPCServer, and OptoDataLink as needed. For additional information, see the *PAC Project Data Sheet*, Opto 22 form 1699.

Architectural Diagrams

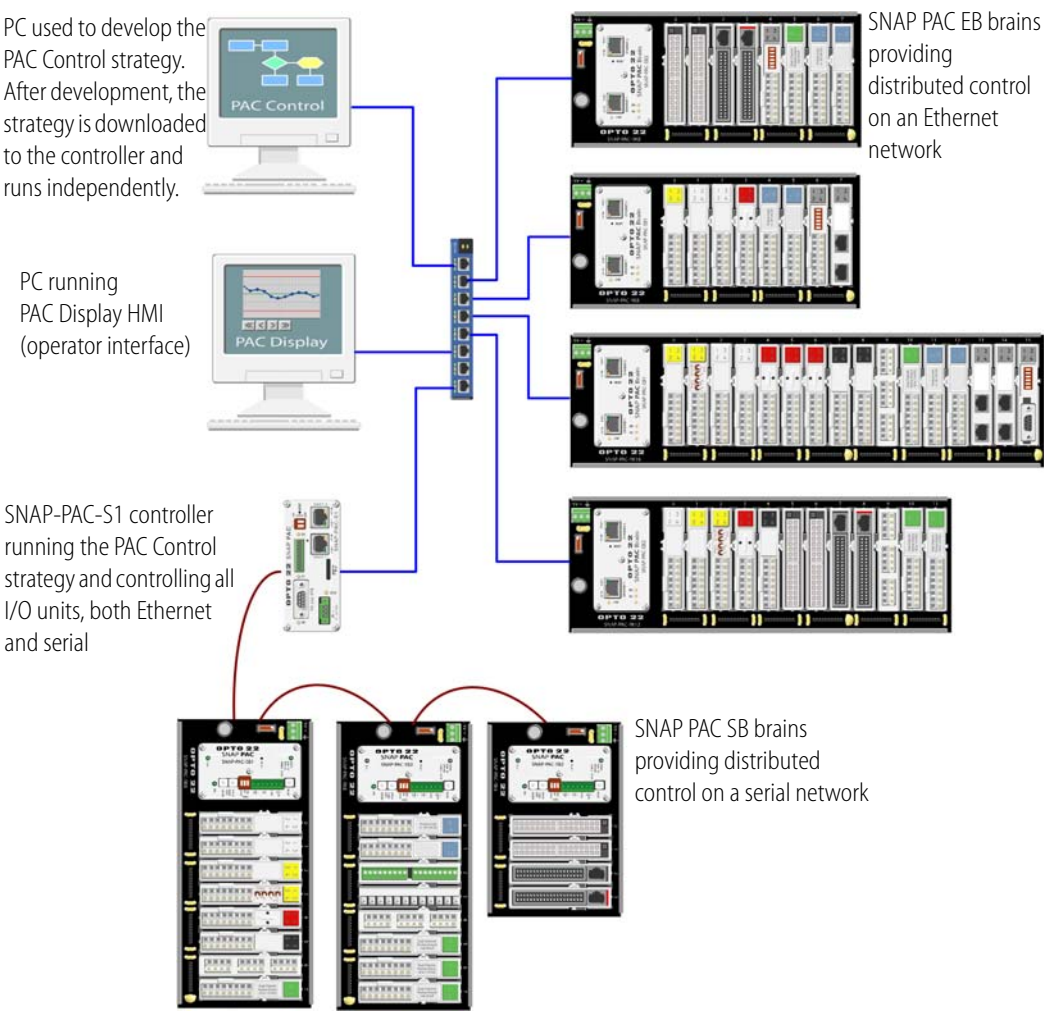
Because SNAP PAC S-series controllers have multiple Ethernet and serial interfaces, these controllers are suitable for use in a variety of system layouts and architectures.

Dual independent Ethernet interfaces, for example, let you configure a network for link redundancy or segmented networking. A PPP serial interface provides a dial-up modem link for remotely located control systems, while two-wire RS-485 support integrates existing Opto 22 *mistic* serial-based I/O units into contemporary Ethernet-based systems.

On Wired+Wireless models, the additional wireless LAN interface offers even more flexibility in system design.

Basic Control System

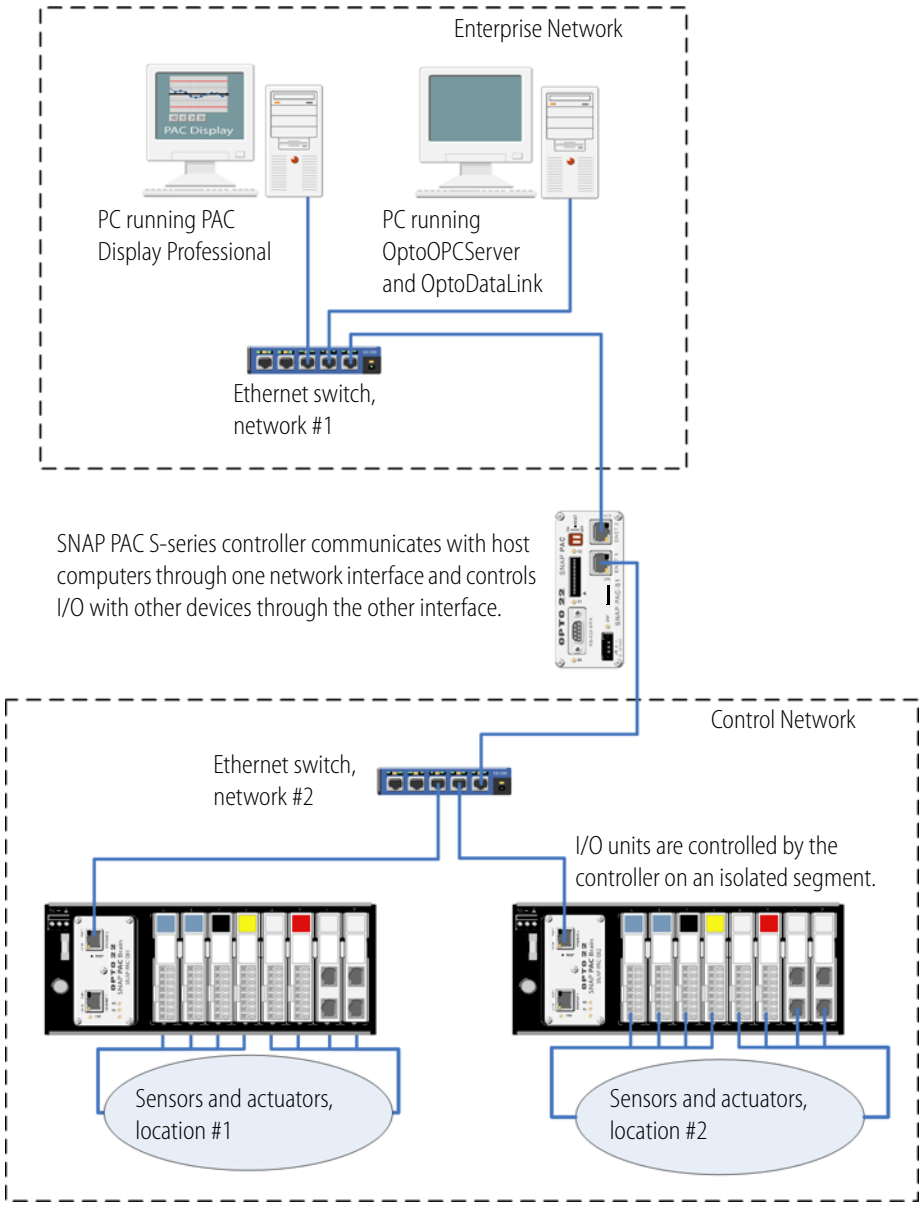
In this basic system, the SNAP-PAC-S1 controls several SNAP PAC I/O units, some on a wired Ethernet network and some on a serial network. PAC Project Basic is all you need.


PC used to develop the PAC Control strategy. After development, the strategy is downloaded to the controller and runs independently.
PAC Control
PC running PAC Display HMI (operator interface)
PAC Display
SNAP-PAC-S1 controller running the PAC Control strategy and controlling all I/O units, both Ethernet and serial
SNAP PAC EB brains providing distributed control on an Ethernet network
SNAP PAC SB brains providing distributed control on a serial network

Segmented Wired Networks

The following diagram shows Opto 22 I/O units connected together over an Ethernet network and controlled by a SNAP PAC S-series controller running a PAC Control strategy. The controller is also connected to a larger, separate enterprise Ethernet network to provide data to two PCs running PAC Display HMI software and OptoOPCServer. Sitting between the two networks, the SNAP PAC S-series controller segments enterprise traffic from the control network.

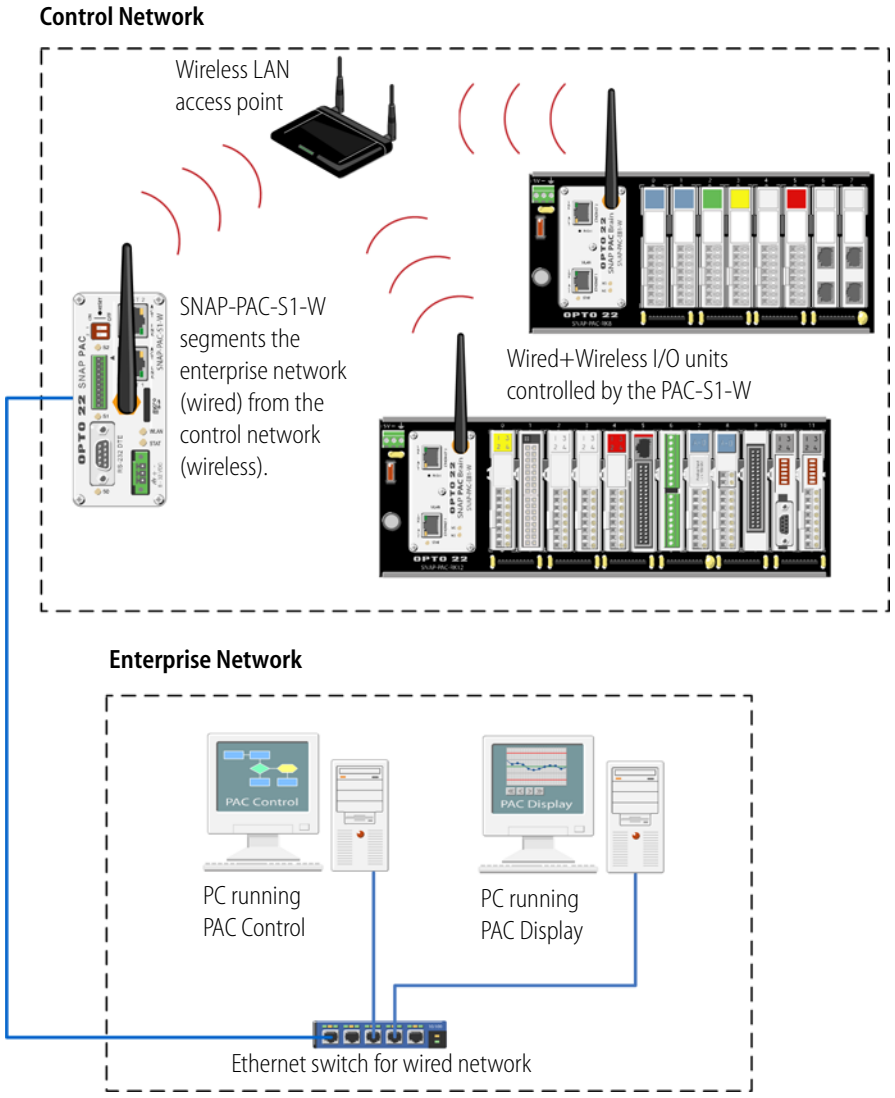
For this system, PAC Display must be configured to access the I/O through the controller rather than directly from the I/O units, since they are on a separate network.


Enterprise Network
PAC Display
PC running PAC Display Professional
PC running OptoOPCServer and OptoDataLink
Ethernet switch, network #1
SNAP PAC S-series controller communicates with host computers through one network interface and controls I/O with other devices through the other interface.
Control Network
Ethernet switch, network #2
I/O units are controlled by the controller on an isolated segment.
Sensors and actuators, location #1
Sensors and actuators, location #2

Wired and Wireless Networks

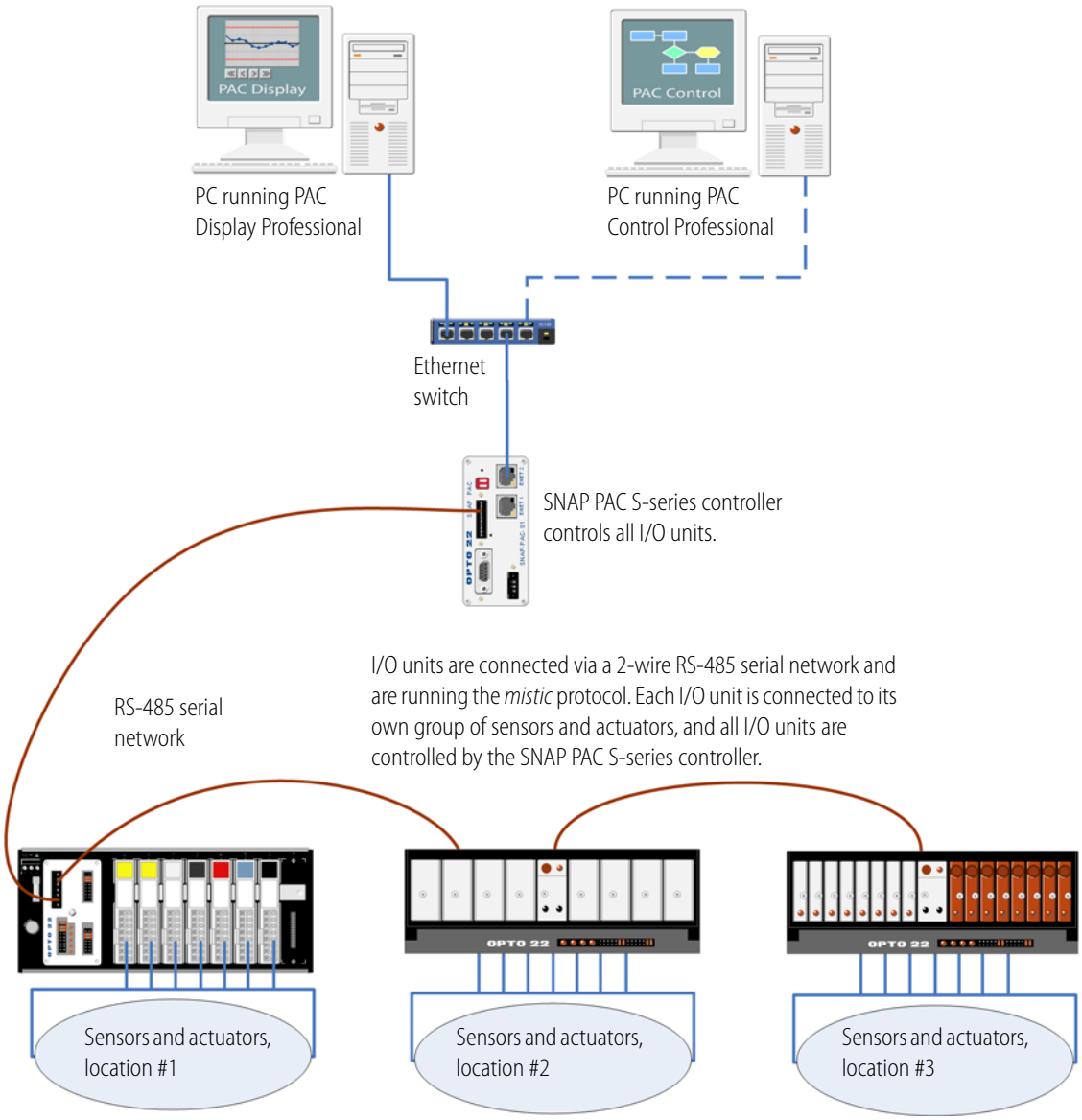
The network shown in this diagram requires a Wired+Wireless S-series controller (SNAP-PAC-S1-W or SNAP-PAC-S2-W). The PAC runs a PAC Control strategy and controls remote I/O units via a wireless access point. The controller is also connected to a separate, wired enterprise network through one of its wired Ethernet network interfaces.

The controller could just as easily talk to the I/O units through a wired network and segment the enterprise PCs on a wireless LAN. In addition, because the Wired+Wireless PAC has two wired interfaces plus the wireless one, it could segment three networks—for example, a wired control network, a wired enterprise network, and a wireless connection with a laptop for maintenance or testing purposes.


Control Network
Wireless LAN access point
SNAP-PAC-S1-W segments the enterprise network (wired) from the control network (wireless).
Wired+Wireless I/O units controlled by the PAC-S1-W
Enterprise Network
PAC Control
PAC Display
PC running PAC Control
PC running PAC Display
Ethernet switch for wired network

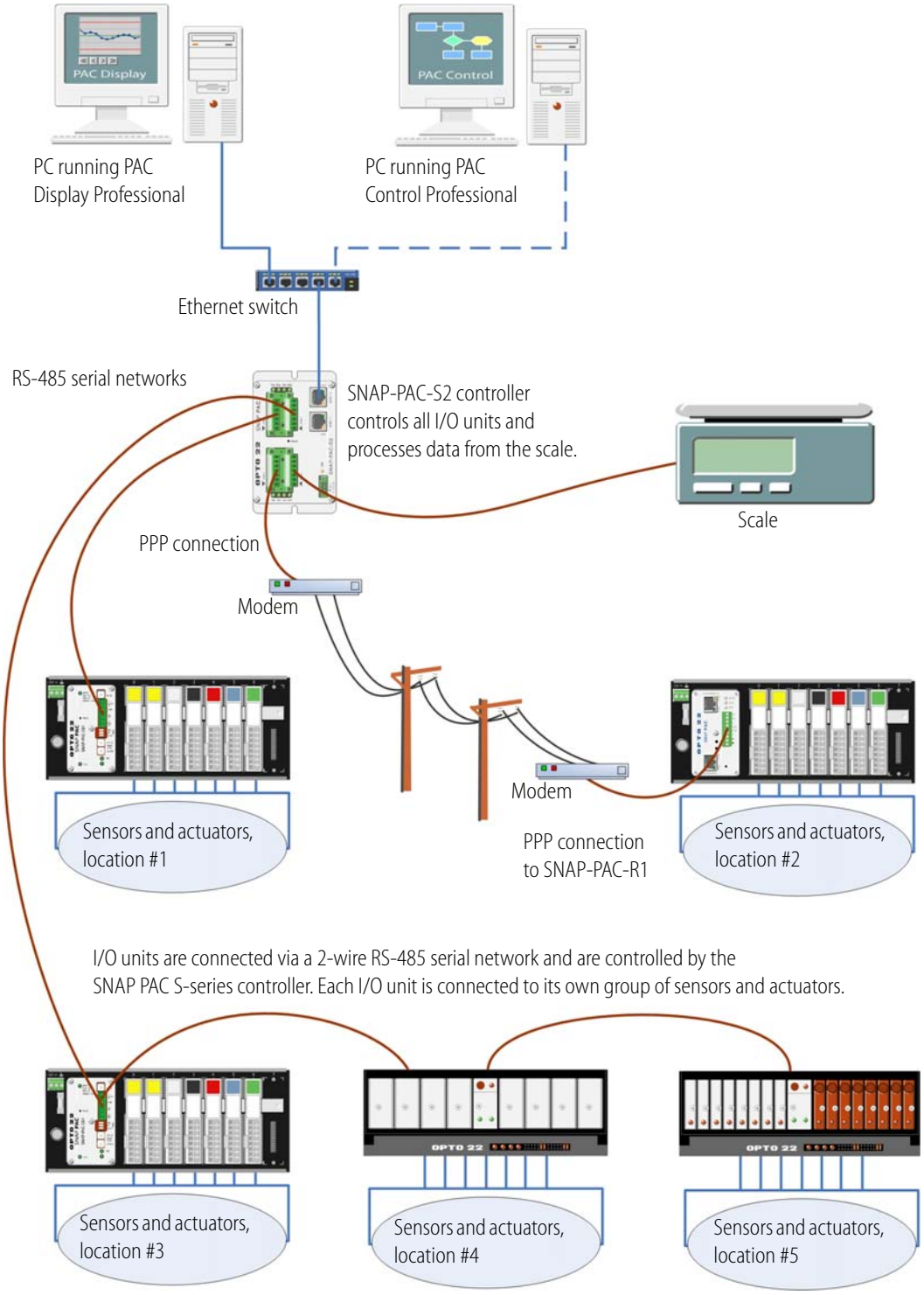
Connections to Legacy Serial-based I/O Units

In the following diagram, a SNAP PAC S-series controller is connected to Opto 22 legacy serial-based I/O units over an RS-485 serial network. The controller is also connected to a larger, separate enterprise Ethernet network to provide process data to a PC running Opto 22's PAC Display HMI software.


PAC Display
PAC Control
PC running PAC Display Professional
PC running PAC Control Professional
Ethernet switch
SNAP PAC S-series controller controls all I/O units.
RS-485 serial network
I/O units are connected via a 2-wire RS-485 serial network and are running the *mistic* protocol. Each I/O unit is connected to its own group of sensors and actuators, and all I/O units are controlled by the SNAP PAC S-series controller.
OPTO 22
OPTO 22
Sensors and actuators, location #1
Sensors and actuators, location #2
Sensors and actuators, location #3

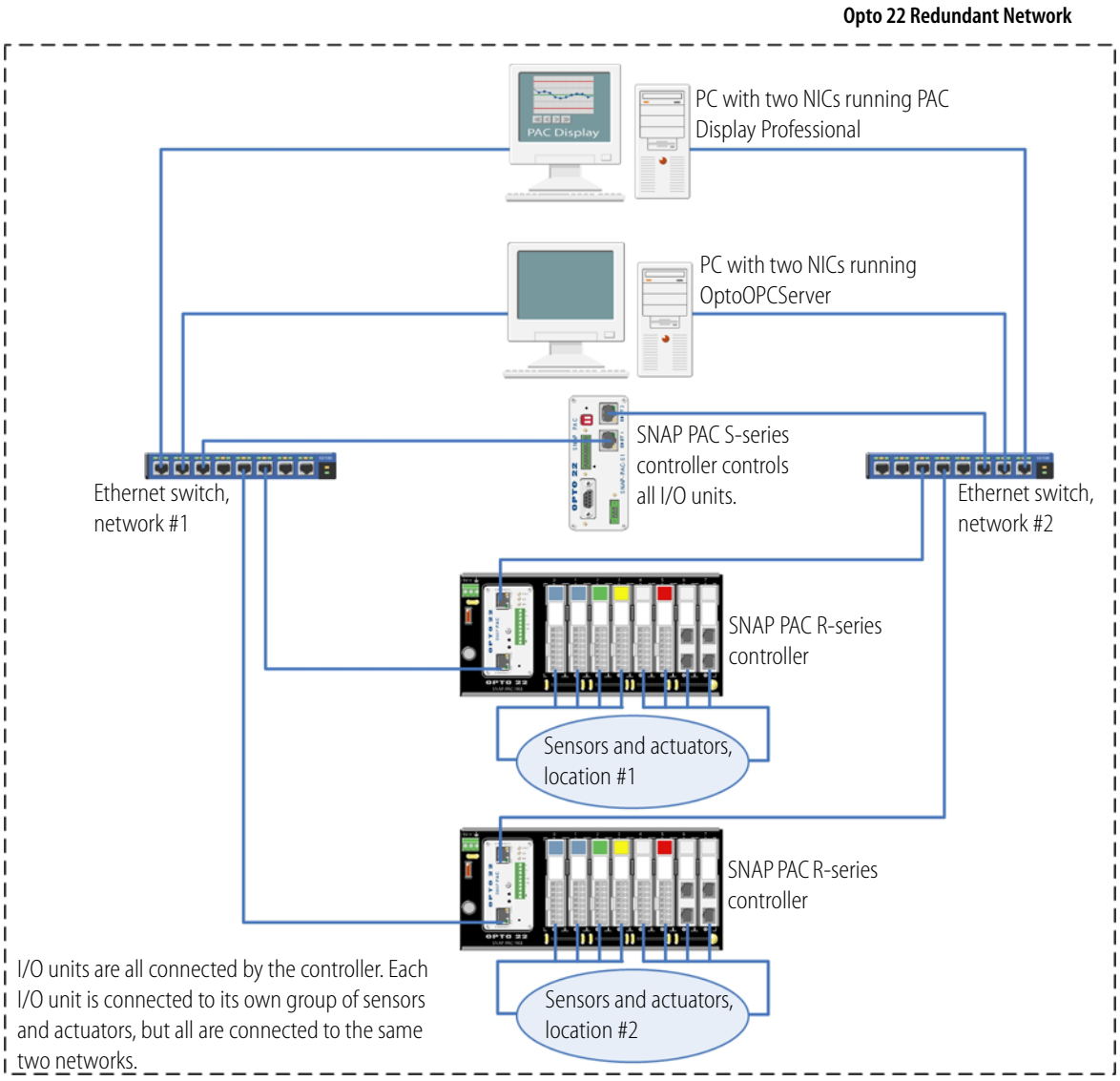
SNAP-PAC-S2 Connections to Serial-based I/O Units

The following diagram shows a SNAP-PAC-S2 controller connected to multiple Opto 22 serial-based I/O units over two RS-485 serial networks, a remote a SNAP Ethernet-based I/O unit over a modem using the Point-to-Point Protocol (PPP), and a serial-based industrial scale.


PAC Display
PAC Control
PC running PAC Display Professional
PC running PAC Control Professional
Ethernet switch
RS-485 serial networks
SNAP-PAC-S2 controller controls all I/O units and processes data from the scale.
Scale
PPP connection
Modem
Modem
PPP connection to SNAP-PAC-R1
Sensors and actuators, location #1
Sensors and actuators, location #2
I/O units are connected via a 2-wire RS-485 serial network and are controlled by the SNAP PAC S-series controller. Each I/O unit is connected to its own group of sensors and actuators.
Sensors and actuators, location #3
Sensors and actuators, location #4
Sensors and actuators, location #5

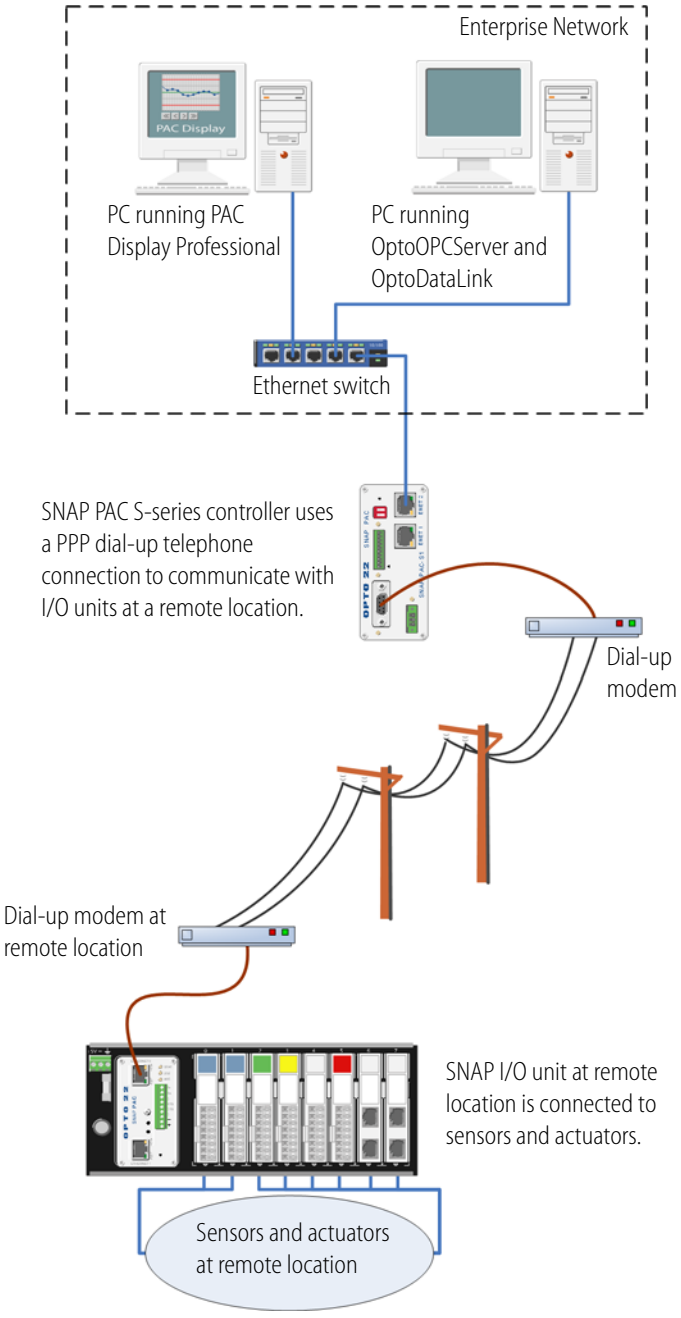
Ethernet Link Redundancy

The following diagram shows a SNAP PAC S-series controller connected to two separate Ethernet network links. This configuration addresses the concern that an Ethernet network may fail or need maintenance, leaving the PC running OptoOPCServer, the PC running PAC Display, the controller, and the I/O units unable to communicate. In this configuration, if one link goes down, devices can still communicate on the other. Each PC has two network interface cards (NICs), and the SNAP PAC S-series controller and the I/O units (SNAP-PAC-R1 and -R2 controllers) have two network interfaces as well.


Opto 22 Redundant Network
PAC Display
PC with two NICs running PAC Display Professional
PC with two NICs running OptoOPCServer
SNAP PAC S-series controller controls all I/O units.
Ethernet switch, network #1
Ethernet switch, network #2
SNAP PAC R-series controller
Sensors and actuators, location #1
SNAP PAC R-series controller
Sensors and actuators, location #2
I/O units are all connected by the controller. Each I/O unit is connected to its own group of sensors and actuators, but all are connected to the same two networks.

Remote Host and I/O Unit Connections Using PPP

For remote monitoring and control, you can use a SNAP PAC S-series controller to connect to a remote host such as a PC or to a SNAP Ethernet-based I/O unit using a dial-up link. For this use, the controller communicates using the Point-to-Point Protocol (PPP) over a modem.


Enterprise Network
PAC Display
PC running PAC Display Professional
PC running OptoOPCServer and OptoDataLink
Ethernet switch
SNAP PAC S-series controller uses a PPP dial-up telephone connection to communicate with I/O units at a remote location.
Dial-up modem
Dial-up modem at remote location
SNAP I/O unit at remote location is connected to sensors and actuators.
Sensors and actuators at remote location

About This Guide

See the following sections for basic information on setting up and maintaining a SNAP PAC S-series controller:

Chapter 2: Quick Start—installing and configuring SNAP PAC S-series controllers.

Chapter 3: Maintenance and Troubleshooting—troubleshooting problems while installing or using the SNAP-PAC-S1 controller on an Ethernet or serial network; getting device information, loading new firmware, changing the controller's IP address, and other maintenance procedures.

Appendix A: Technical Specifications—specifications, connectors, indicators, pinouts, and dimensions.

Appendix B: PPP Support in Microsoft Windows—configuring Windows dial-up networking on any PC that will dial in to the controller.

Related Documentation

You may also need the following documentation, depending on your application

For this information	See this guide	Form #
Configuring I/O points and system functions	*PAC Manager User's Guide*	1704
Designing flowchart-based control programs for the system	*PAC Control User's Guide*	1700
	PAC Control Command Reference	1701
	PAC Control Commands Quick Reference Card	1703
Writing programs for Opto 22 memory-mapped devices using OptoMMP	*OptoMMP Protocol Guide*	1465
Installing and using SNAP PAC R-series controllers	*SNAP PAC R-series Controller User's Guide*	1595
Installing and using SNAP PAC EB and SB-series brains	*SNAP PAC Brains User's Guide*	1690
Communicating with I/O units using OPC	*OptoOPCServer User's Guide*	1439
Communicating with I/O units using Modbus/TCP	*Modbus/TCP Protocol Guide*	1678
Communicating with I/O units using EtherNet/IP	*EtherNet/IP for SNAP PAC Protocol Guide*	1770
Programming your own applications for SNAP PAC S-series controllers using the OptoMMP Communication Toolkit (previously called the SNAP Ethernet I/O Driver Toolkit) or the OptoMMP memory-mapped protocol	*OptoMMP Protocol Guide*	1465
Moving to the SNAP PAC System with older hardware and software	*SNAP PAC System Migration Technical Note*	1688

Some of this documentation is on the CD that came with the controller; all forms are available on our website (www.opto22.com) for downloading. The easiest way to find one is to search on the form number.

For Help

If you have problems installing or using a SNAP PAC S-series controller and cannot find the help you need in this guide, contact Opto 22 Product Support.

Phone:	800-TEK-OPTO (835-6786) 951-695-3080 (Hours are Monday through Friday, 7 a.m. to 5 p.m. Pacific Time)
Fax:	951-695-3017
Email:	support@opto22.com
Opto 22 website:	www.opto22.com

NOTE: Email messages and phone calls to Opto 22 Product Support are grouped together and answered in the order received.

When calling for technical support, be prepared to provide the following information about your system to the Product Support engineer:

- Software and version being used
- Controller firmware version
- PC configuration
- A complete description of your hardware and operating systems, including:
  - switch configuration
  - type of power supply
  - types of I/O units installed
  - third-party devices installed (for example, barcode readers)
- Specific error messages seen.

2: Quick Start

Installing and Configuring the Controller

What You Will Need

- PC running Microsoft Windows 2000, XP, or Vista workstation operating system, with a 10/100 MB Ethernet interface, the TCP/IP protocol installed, and a valid IP address, on the same subnet as the controller
- Crossover cable (for direct connection to the PC) or an available connection to a standard 10BASE-T or 100BASE-TX Ethernet network
- SNAP PAC S-series controller
- CD that came with the controller or PAC Project Professional CD (purchased separately)
- 8–32 VDC power supply (see "Power Supply Recommendations" on page 16 for specific information and recommendations)
- Small flathead screwdriver
- One or more of the following, depending on your I/O system requirements:
  - Opto 22 SNAP PAC I/O units on the same Ethernet network as the controller.
  - For Wired+Wireless PACs, a wireless local area network (WLAN) and Wired+Wireless SNAP PAC I/O units
  - Opto 22 legacy SNAP Ethernet-based I/O units—SNAP Simple I/O, SNAP Ethernet I/O, or SNAP Ultimate I/O units—on the same Ethernet network as the controller.
  - Opto 22 RS-485 serial-based I/O units—SNAP PAC serial brains, serial B3000, SNAP-BRS, B100/B200 brains, or *mistic* remote bricks (G4D16R, G4D32RS, G4A8R)—on a two-wire RS-485 network.

Installing Software

In your CD-ROM drive, insert the CD that came with the SNAP PAC S-series controller. The installation wizard should start automatically. If it doesn't, use Windows Explorer to navigate to your CD-ROM drive and then double-click setup.exe.

Power Supply Recommendations

Opto 22 recommends that the SNAP PAC S-series controller be powered with an Opto 22 SNAP-PS24 or SNAP-PS24U power supply. In place of one of these power supplies, Opto 22 recommends an 8-32 VDC linear supply with adequate current ratings for the load. For more information on power requirements, see "Specifications" on page 51.

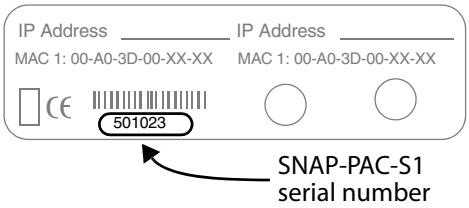
Change to SNAP-PAC-S1 Power Input Range

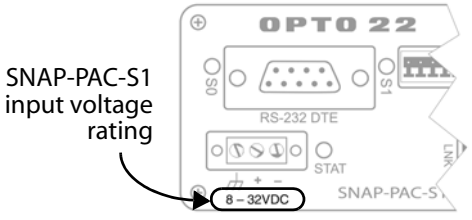
Current SNAP-PAC-S1 controllers have an 8–32 VDC input range, but earlier SNAP-PAC-S1 controllers use an 8–24 VDC input range. **Before applying power to the controller, confirm that the input voltage is within the voltage range shown on the faceplate.**

The voltage input rating can also be determined based on the SNAP-PAC-S1's serial number as follows:

- SNAP-PAC-S1 controllers *with serial number 500000 and higher* have an 8–32 VDC voltage input rating.
- SNAP-PAC-S1 controllers with serial numbers lower than 500000 have an 8–24 VDC input rating. **Using an input voltage above this range will cause damage that is not covered by the warranty.**

The SNAP-PAC-S1 serial number appears on the sticker on the side of the unit. The input voltage rating is shown on the top cover of the controller.





Installing Hardware

1. Install Opto 22 I/O units according to instructions in the brain's user's guide.

   This guide is on the CD that was shipped with the I/O unit's brain; it is also available from our website at www.opto22.com.

2. Choose a convenient mounting location for the SNAP PAC S-series controller and either panel-mount or DIN-rail mount it according to the diagrams on page 25 and page 29.
3. Confirm that the power supply to be used with the controller is turned off or unplugged, and discharge any residual charge that may remain in the power supply.
4. With the power supply off or unplugged, connect the power supply to the controller.

   CAUTION: *Reversing wire polarity may cause damage to your controller. This damage is not covered by Opto 22's warranty. If you are not certain about the polarity of the wires on your power supply, check with a meter.*

a. With the power supply off or unplugged, connect the **+** (positive) lead from the power supply (normally red) to the **+** (positive) terminal on the face of the controller.

b. Connect the COM wire from the power supply (normally black) to the **–** (negative) terminal on the face of the controller.

c. Connect a lead from a known earth/chassis ground to the ⏚ (ground) terminal on the face of the controller.

IMPORTANT: *Do not turn on power to the controller.*

5. Using Category 5 or superior solid unshielded twisted-pair cable, connect the SNAP PAC S-series controller using Ethernet port ENET 1 in one of the following ways:

– (Recommended for initial configuration) Connect to a PC directly, using an Ethernet crossover cable.

NOTE: If you use a crossover cable, make sure to assign a fixed IP address to the network card (NIC)on your computer. Otherwise, if your network card is configured to get its IP address via DHCP, when you unplug the computer from the network, the computer will no longer have an IP address. When you are finished using the crossover cable, you can change the setting back to DHCP.

NOTE: Wired+Wireless models must be initially configured using a wired interface. After you've assigned IP addresses and configured wireless communication parameters, you can communicate with the PAC on the wireless LAN.

– Connect to a standard 10BASE-T or 100BASE-TX Ethernet network that has a PC on the same subnet as the controller and does NOT have a Dynamic Host Configuration Protocol (DHCP) server.

NOTE: When connecting the contoller to a managed switch, make sure the managed switch's port configuration is set to Auto for the Duplex setting and Auto for the Speed setting.

Maximum cable or segment length is 100 meters; minimum cable length is one meter.

6. If the controller will connect to I/O units on an RS-485 serial network, connect the serial cable following the instructions in "RS-232 and RS-485 Serial Networking" below.

IMPORTANT: *Do not turn on power to the controller.*

7. **Before** turning on power to the controller, follow steps in Opto 22 form 1704, the *PAC Manager User's Guide*, to assign the controller an IP address.

This guide is in Adobe Acrobat PDF format on the CD that came with the controller and is also available from our website, www.opto22.com. Note that you can use PAC Manager to assign IP addresses to the controller and I/O units at the same time.

RS-232 and RS-485 Serial Networking

SNAP PAC S-series controllers provide both RS-232 and RS-485 serial communication interfaces. Serial communication ports and their corresponding wiring pinouts are shown on pages 53 and 55.

RS-232 Connections

You can use the RS-232 ports on a SNAP PAC S-series controller to:

- Direct connect to a device that supports RS-232 communication.
- Connect to a modem and make a serial Point-to-Point Protocol (PPP) connection to a remote PC or other device that supports PPP.

Use PAC Manager to configure the RS-232 ports for the way you want to use them (see the instructions in the *PAC Manager User's Guide*). Note that the controller cannot make a direct RS-232 serial connection with an Opto 22 I/O unit; however, it is possible to connect to an Opto 22 I/O unit that supports PPP communications.

Attaching a Modem to the Controller

To work properly with the SNAP PAC S-series controller, a modem must be able to store settings in non-volatile RAM (NVRAM) and default to those settings on reset.

IMPORTANT: *Any modem used with the controller must implement the Carrier Detect (CD) signal or use a custom cable that connects CD to Data Terminal Ready (DTR).*

1. Connect the modem to the controller using a modem cable with female DB-9 connector. If necessary, see page 53 or 55 for pinout details.
2. Store configuration settings to the modem's NVRAM, following instructions in the user's guide for your modem.

   *NOTE: Configuration settings **must** be stored to the modem's NVRAM so they will be loaded when the controller sends a reset command to the modem.*

3. If PCs will dial up the controller, set up Windows dial-up networking on the PCs that will call the controller. See the section for your operating system in Appendix B, "B: PPP Support in Microsoft Windows."
4. If you want the controller to dial up a PC, set up a remote access server (RAS) on the PC. This is also described in Appendix B, "B: PPP Support in Microsoft Windows."

RS-485 Connections

You can use an RS-485 serial port on a SNAP PAC S-series controller to connect to Opto 22 I/O units on a two-wire, RS-485 serial network. These I/O units include SNAP PAC SB-series brains, serial B3000 brains, and *mistic* remote bricks such as the G4D16R, G4D32RS, and the G4A8R. Both the PAC S1 and PAC S2 support optional *mistic* signal interrupts. In addition, on the SNAP-PAC-S2 controller you can use PAC Manager to configure up to four RS-485 ports either as 2-wire or 4-wire connections.

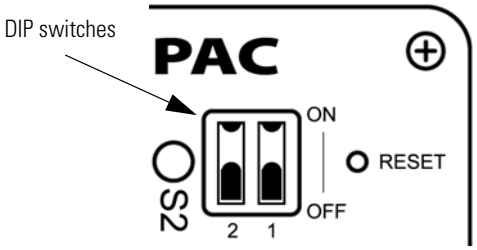
Configuring RS-485 Connections on SNAP-PAC-S1 Controllers

RS-485 bias and termination settings are configured using two DIP switches located on the top of the controller.

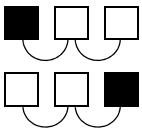
Bias: Only one device on an RS-485 network should have bias turned on. If there are no other devices with bias active, you can set the SNAP PAC S-series controller to do so.

Termination: Termination settings depend on the controller's location on the RS-485 network. Settings for different controller locations are shown in the table below.

Switch	Position	Description
1	ON	Bias: active
	OFF	Bias: inactive
2	ON	Termination: active
	OFF	Termination: inactive



(Portion of top view)

SNAP PAC S-series controller location on RS-485 network	RS-485 termination
 At the End	Termination Active
In the Middle (floating)	Termination Inactive

Configuring RS-485 Connections on SNAP-PAC-S2 Controllers

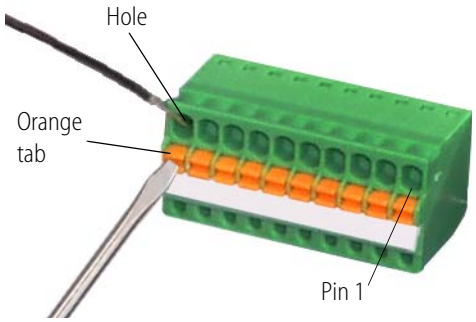
The serial ports on SNAP-PAC-S2 controllers are software configurable using PAC Manager. This includes mode, termination, and bias. For more information, see the PAC Manager User's Guide. See also, "Assigning Serial Ports on SNAP-PAC-S2 Controllers" on page 24.

Wiring the 10-pin Serial Connector on SNAP-PAC-S1 Controllers

Serial ports1 and 2 on SNAP-PAC-S1 controllers share a 10-pin pluggable connector (Phoenix Contact, part number FK-MC 0.5 - 2.5, supplied with the controller). When inserting and removing wire leads into this connector, do the following:

1. Completely depress the small orange tab for the appropriate opening with a small screwdriver.
2. While holding the tab down with the screwdriver, insert or remove the wire as needed.
3. Release the orange tab.

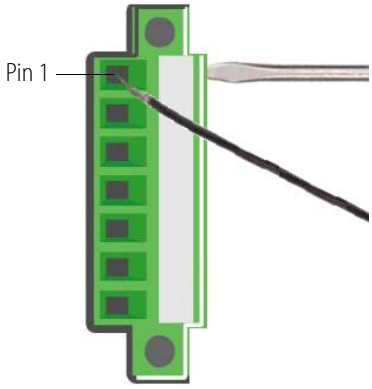
For a pinout of the connector, see "SNAP-PAC-S1 and -FM Connectors, Indicators, and Pinouts" on page 53.



Wiring the 7-pin Serial Connector on SNAP-PAC-S2 Controllers

Each of the four serial ports on SNAP-PAC-S2 controllers uses a 7-pin pluggable connector supplied with the controller (Eby part number EB1381M-07-500 or equivalent). Using the screws on the side of the connector, insert or remove the wires as needed.

For a pinout of this connector, see "SNAP-PAC-S2 Connectors, Indicators, and Pinouts" on page 55.



***CAUTION**: Do not use communication port connectors from a legacy OptoControl controller*. Legacy connectors will fit in a SNAP-PAC-S2, but the pin orientation is different. Instead, use the connectors supplied with the SNAP-PAC-S2 controller.*

**Legacy OptoControl Controllers*

G4LC32	*G4LC32ISA-LT*	*M4RTU*
G4LC32SX	*M4*	*SNAP-LCM4*
G4LC32ISA	*M4IO*	*SNAP-LCSX/PLUS*

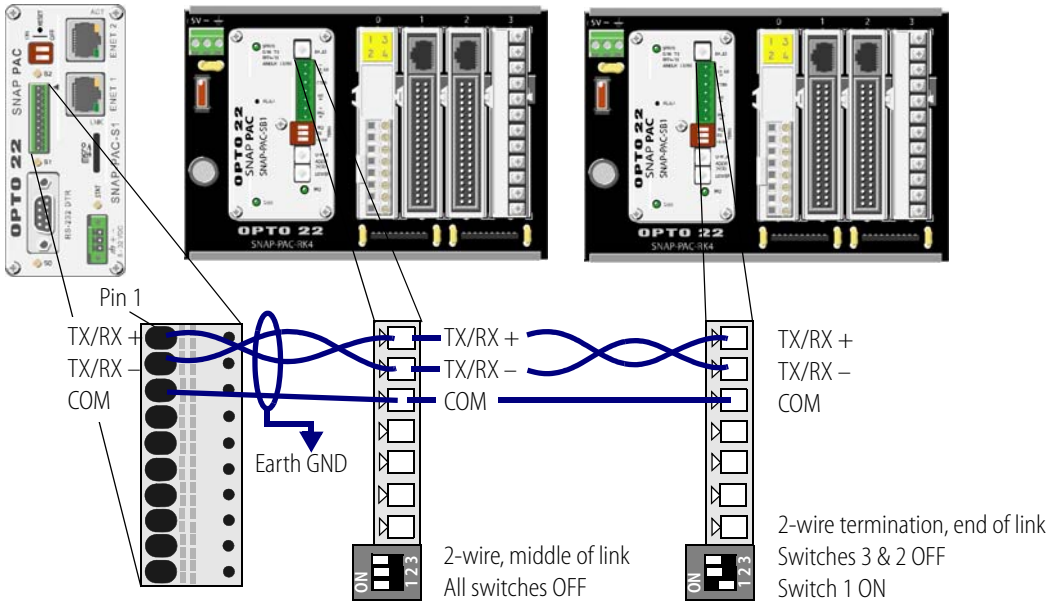
Serial Wiring Diagrams

NOTE: SNAP-PAC-S1 controllers only support 2-wire RS-485.

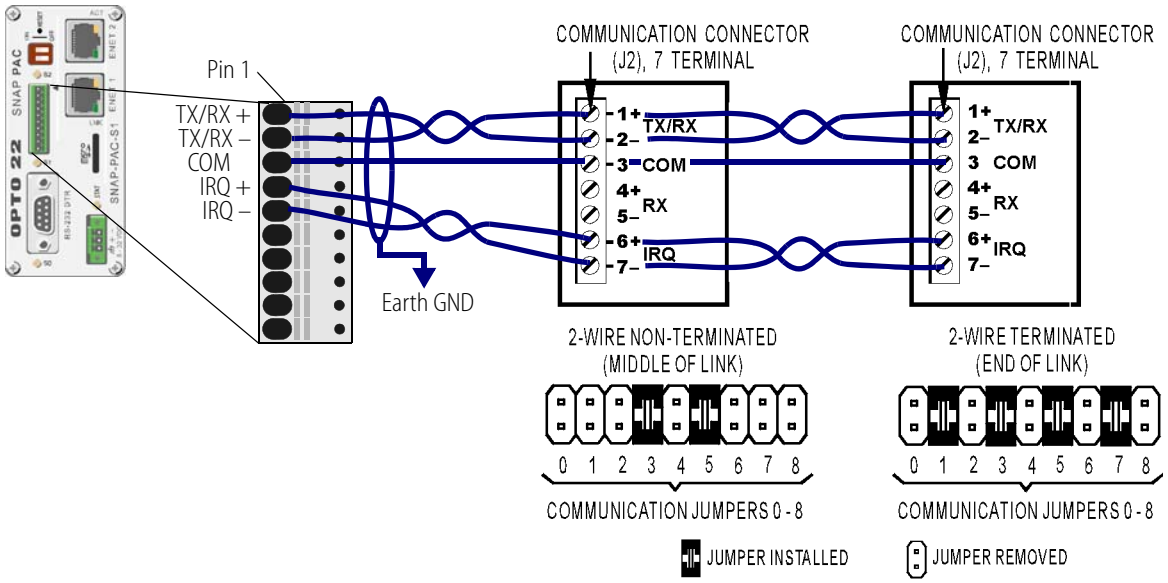
Wiring SNAP-PAC-S1 Controllers to a SNAP PAC SB-Series Brain

Also see "SNAP-PAC-S1 and -FM Connectors, Indicators, and Pinouts" on page 53 and "SNAP-PAC-S1-W Connectors and Indicators (Wired+Wireless)" on page 54.

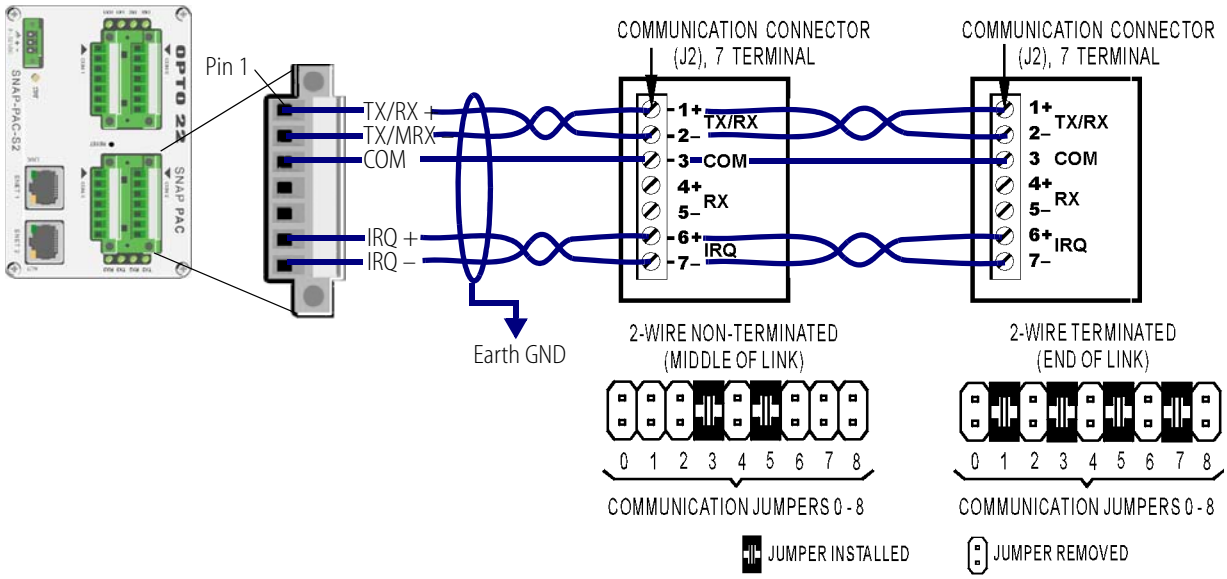
Two-wire



Wiring SNAP-PAC-S1 Controllers to a B3000 *mistic* Brain with an Interrupt Line



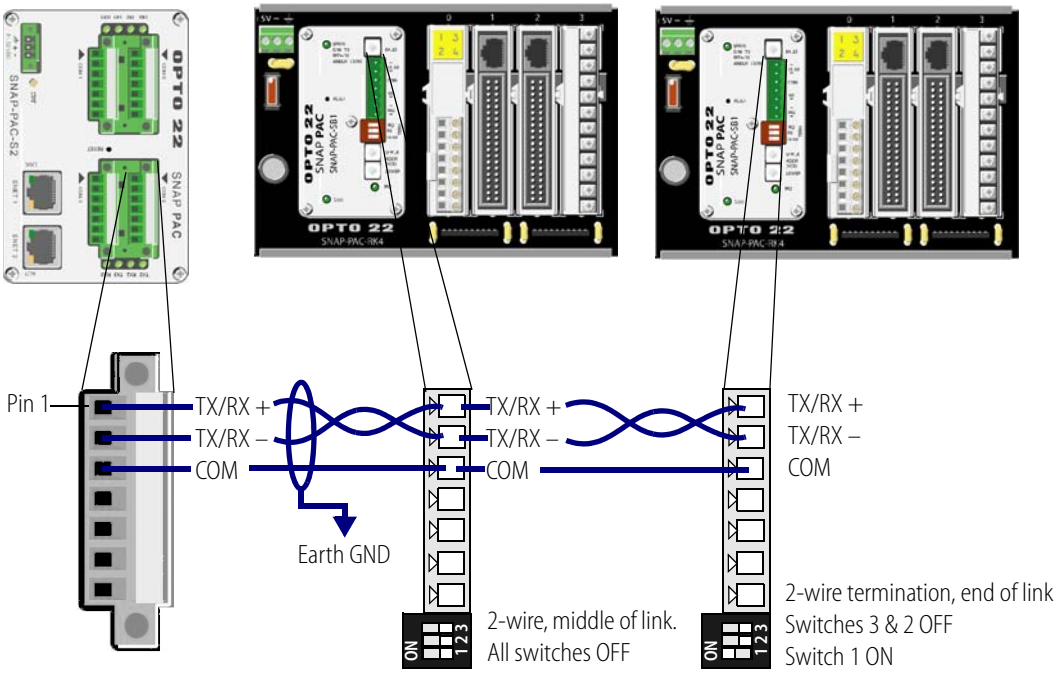
Wiring SNAP-PAC-S2 Controllers to B3000 *mistic* Brains with an Interrupt Line



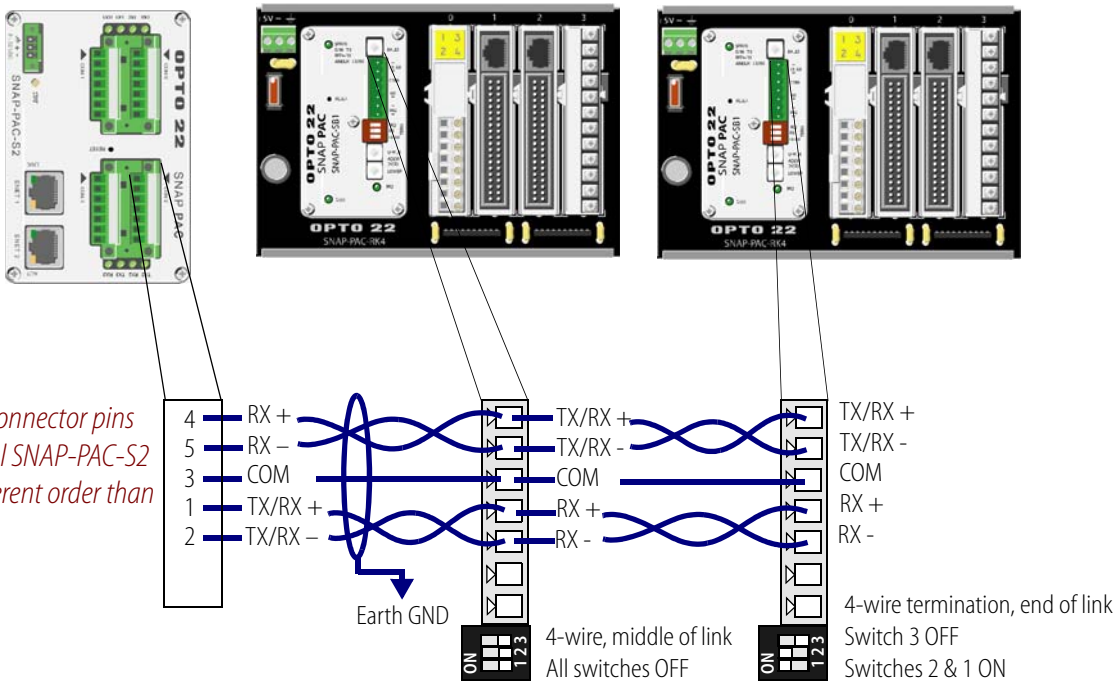
Wiring SNAP-PAC-S2 Controllers to a SNAP PAC SB-Series Brain

Also see "SNAP-PAC-S2 Connectors, Indicators, and Pinouts" on page 55 and "SNAP-PAC-S2-W Connectors and Indicators (Wired+Wireless)" on page 56.

Two-wire



Four-wire



NOTE: The connector pins on an actual SNAP-PAC-S2 are in a different order than shown here.

Assigning an IP Address

See instructions in Opto 22 form 1704, the *PAC Manager User's Guide*, to assign IP addresses to the SNAP PAC S-series controller using a wired Ethernet connection.

SNAP PAC controllers have two independent Ethernet network interfaces, labeled on the top of the controller as ENET1 and ENET2. Wired+Wireless PACs have a third network interface for the wireless LAN. You can use these separate interfaces to segment the control network from the company network or for other purposes. Use PAC Manager to assign the secondary and wireless addresses and configure settings. Make sure each interface is on a separate IP subnet and receives a unique IP address.

Assigning Serial Ports on SNAP-PAC-S2 Controllers

See instructions in Opto 22 form 1704, the *PAC Manager User's Guide*, to configure serial ports for SNAP-PAC-S2 controllers.

Each of the four serial ports on a SNAP-PAC-S2 can be configured either as an RS-232 serial port or an RS-485 serial port. Up to four ports on the SNAP-PAC-S2 can be used for I/O, and up to four ports can be used for general purpose serial communication. Only one port on the SNAP-PAC-S2 may used for PPP communication.

By default the serial ports are as follows:

Port	Factory Default Mode
0	RS-232 (PPP)
1	RS-232 (not PPP)
2	RS-485 (2-wire 485 with termination and bias)
3	RS-485 (2-wire 485 with termination and bias)

Mounting the Controller

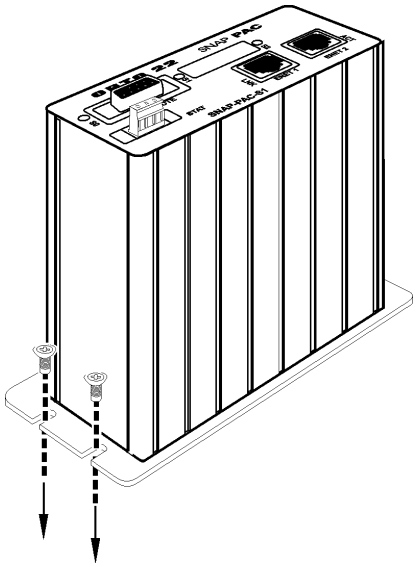
The SNAP PAC S-series controller can be panel mounted or mounted on a DIN rail. DIN-rail mounting requires an adapter clip, part number SNAP-PSDIN (not included).

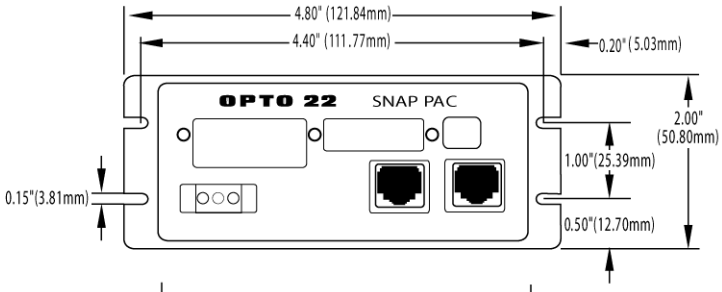
Panel Mounting and Dimensions

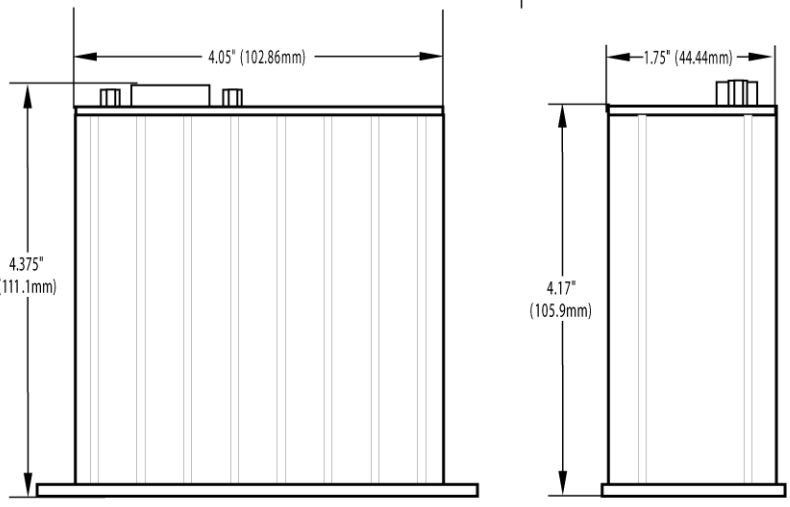
SNAP-PAC-S1, SNAP-PAC-S1-FM, SNAP-PAC-S1-W

Use two screws on each side of the SNAP-PAC-S1 controller to mount it to a panel.

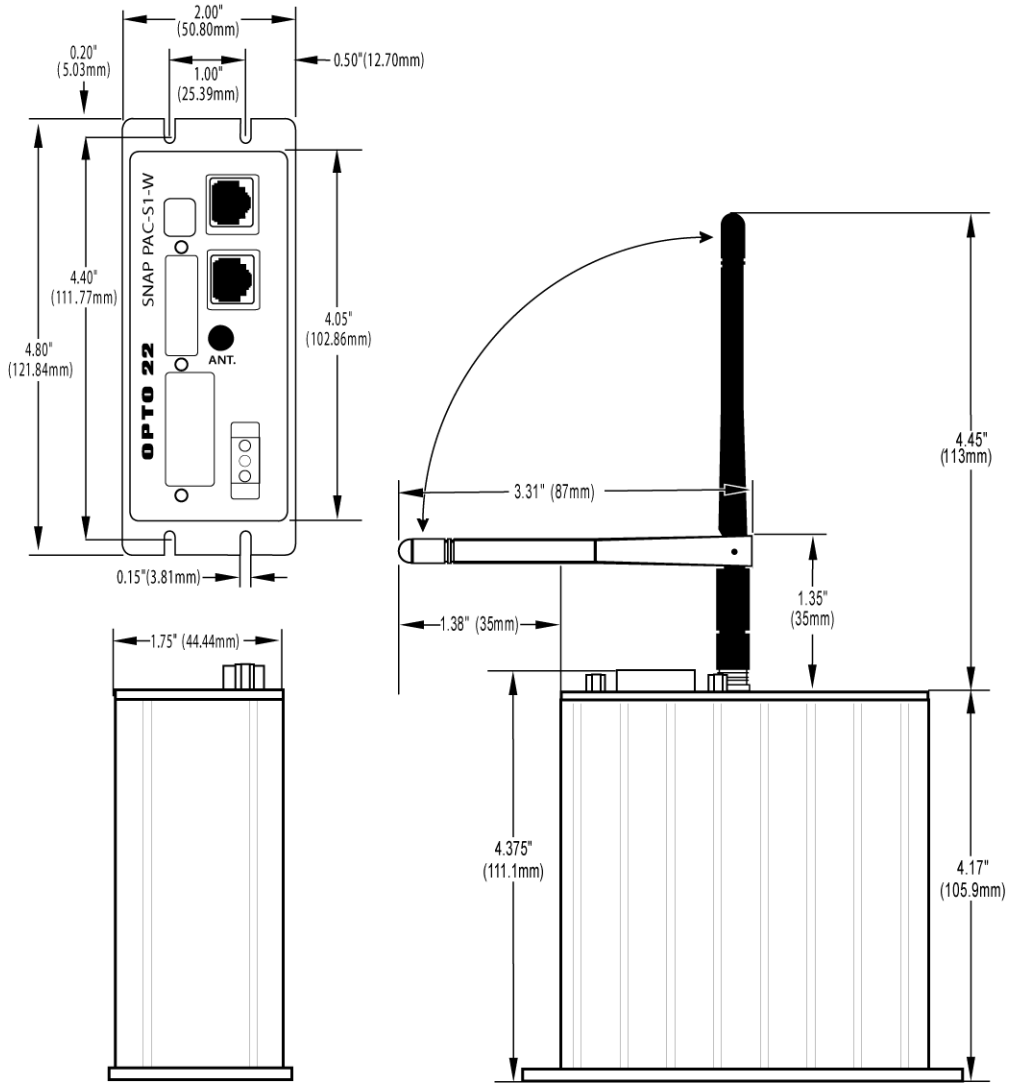
See the next page for antenna dimensions on the SNAP-PAC-S1-W.







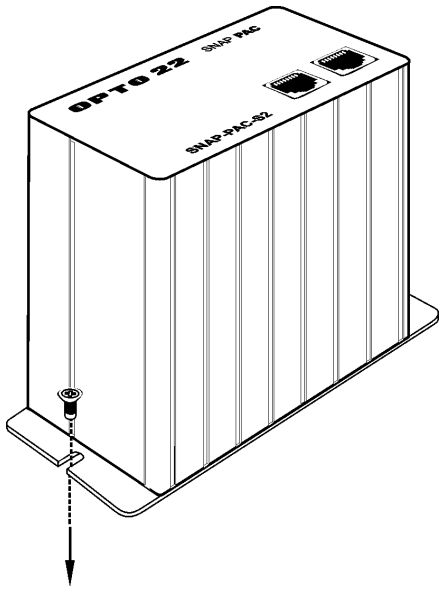
SNAP-PAC-S1-W Antenna Dimensions

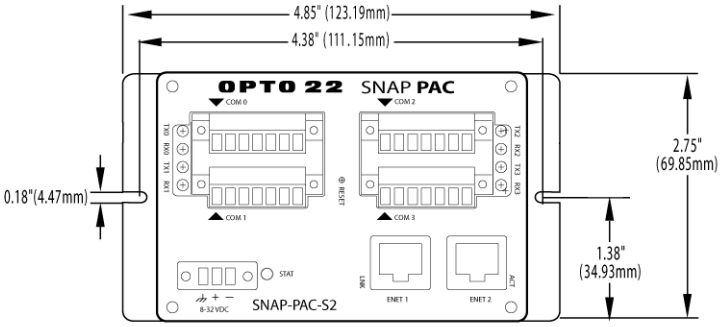


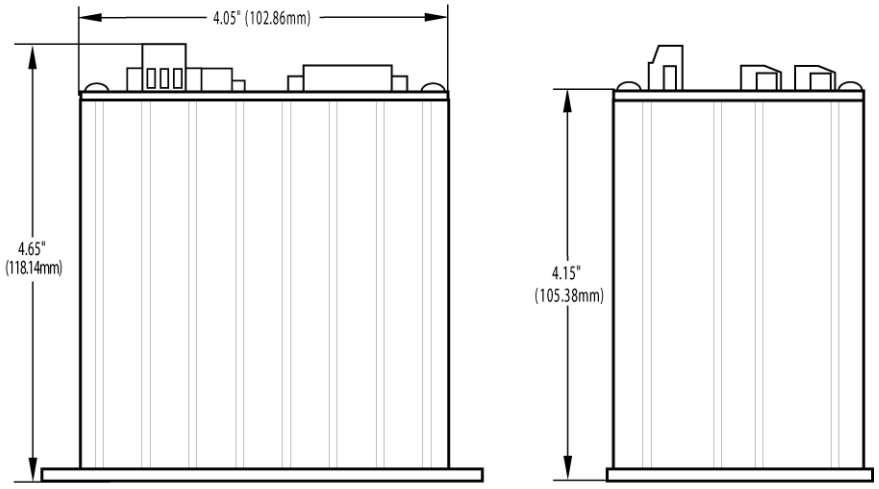
SNAP-PAC-S2 and SNAP-PAC-S2-W

Use one screw on each side of the SNAP-PAC-S2 controller to mount it to a panel.

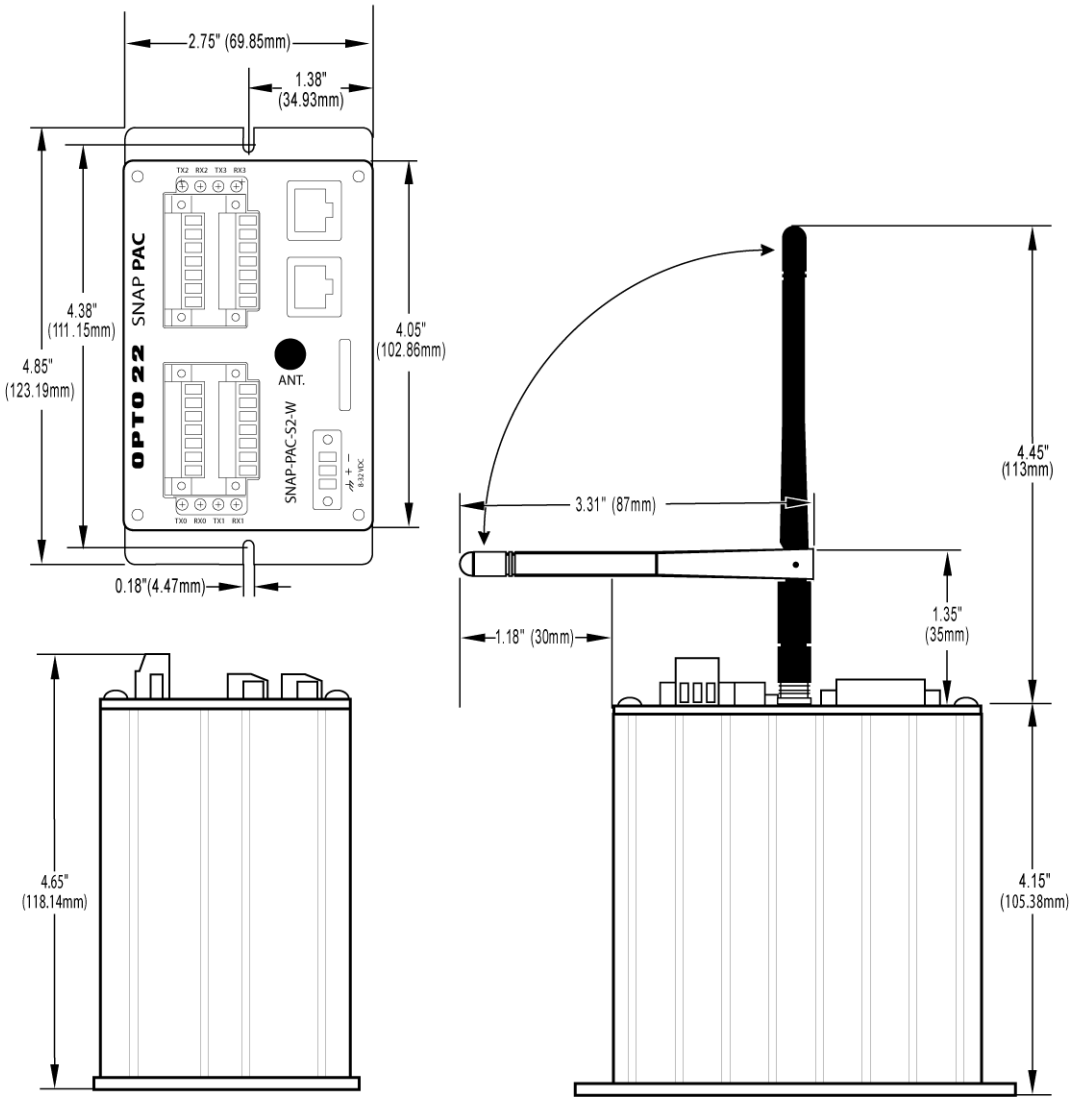
See the next page for antenna dimensions on the SNAP-PAC-S2-W.







SNAP-PAC-S2-W Antenna Dimensions



DIN-Rail Mounting and Dimensions

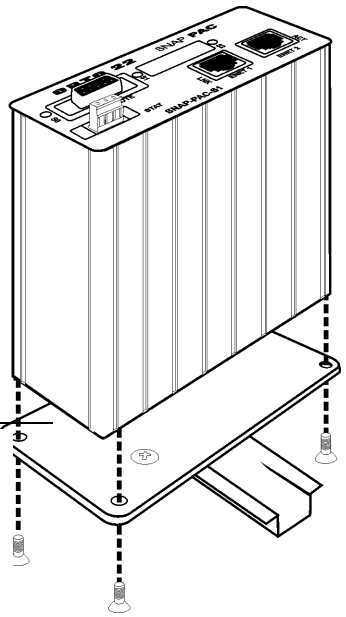
SNAP-PAC-S1, SNAP-PAC-S1-FM, and SNAP-PAC-S1-W

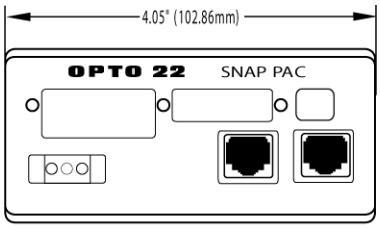
DIN-rail mounting requires an adapter clip, part number SNAP-PSDIN (not included).

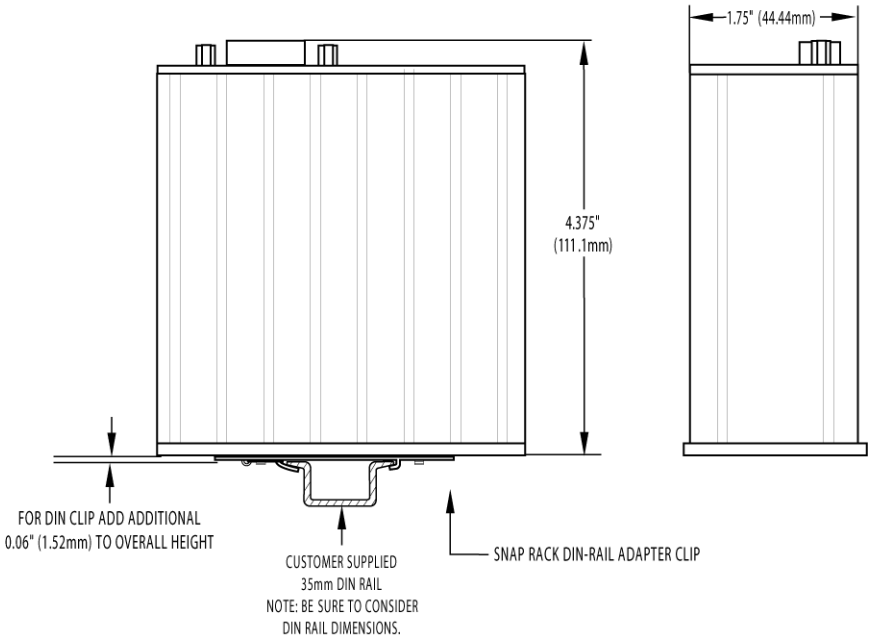
For DIN-rail mounting, remove the four screws that fasten the panel mounting base plate to the controller. **Save screws.** Remove the base plate.

Use the four screws to fasten the DIN-rail adapter clip to the bottom of the controller, as shown.

Antenna dimensions for the SNAP-PAC-S1-W are on page 26.







DIN-Rail Mounting and Dimensions (continued)

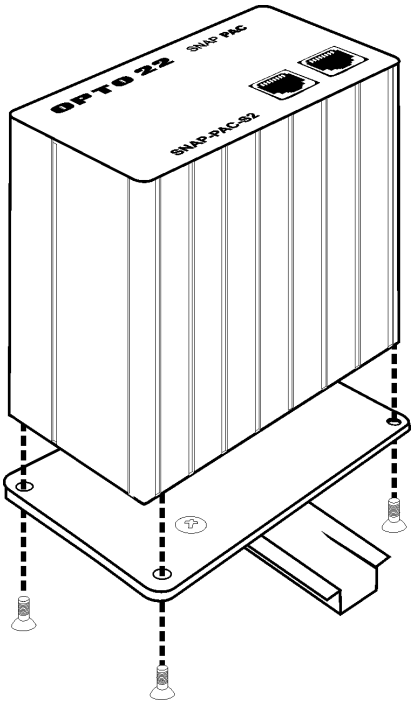
SNAP-PAC-S2 and SNAP-PAC-S2-W

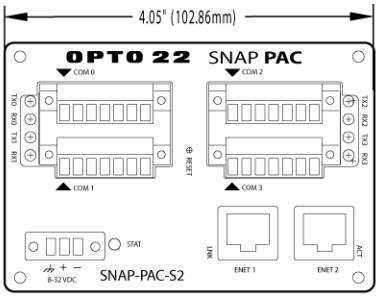
DIN-rail mounting requires an adapter clip, part number SNAP-S2DIN (not included).

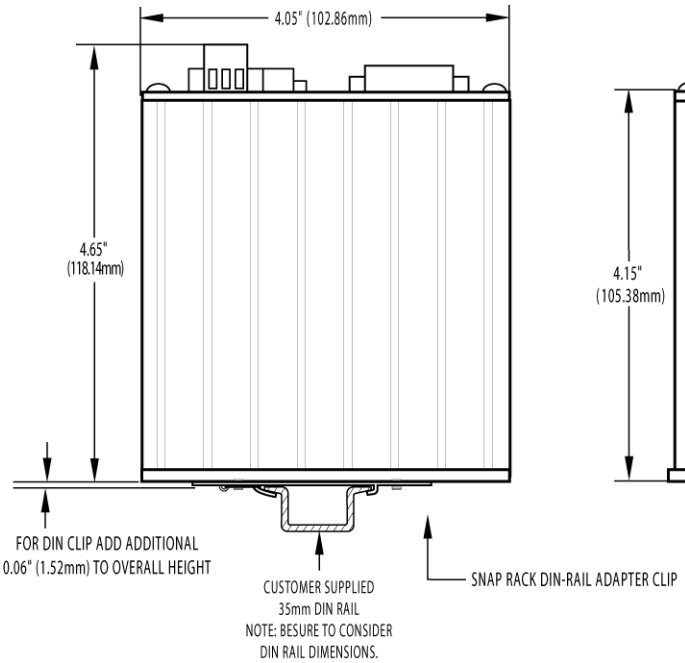
For DIN-rail mounting, remove the four screws that fasten the panel mounting base plate to the controller. **Save screws.** Remove the base plate.

Use the four screws to fasten the DIN-rail adapter clip to the bottom of the controller, as shown.

SNAP-PAC-S2-W antenna dimensions are on page 28.







About the Controller's Memory Map

Like SNAP Ethernet-based brains, a SNAP PAC S-series controller uses a memory mapped system for storing data and making that data available to other devices on the Ethernet network. This data includes configuration data, status information about the controller itself, and PAC Control strategy variable data that may be needed by a peer on the network.

Although SNAP PAC S-series controllers are designed to run PAC Control strategies, you can also write your own software applications to communicate with the controller's memory map, either instead of or in addition to using PAC Control. You can use the OptoMMP Communication Toolkit or the IEEE 1394-based protocol for writing your applications. Both are explained in Opto 22 form 1465, the *OptoMMP Protocol Guide*, which also includes complete details of the memory map. Although this guide is written for I/O units, you can use the same information for a SNAP PAC S-series controller. Just be aware that many sections do not apply, since the controller's memory map doesn't include any I/O point or related information.

The SNAP PAC S-series controller's memory map includes only the following areas:

Status Area Read	PPP Configuration
Communications Port Configuration	PPP Status
Date and Time Configuration	microSC Card
Status Area Write	IP Settings
Security Configuration	WLAN Configuration
Scratch Pad	WLAN Status

Using Data for Peer-to-Peer Communication

Scratch Pad areas within the SNAP PAC S-series controller's memory map provide a way for other devices on the Ethernet network to access data in the controller. For descriptions of the Scratch Pad areas—bits, integers, floats, and strings—see the *PAC Manager User's Guide*. For help in using PAC Control commands to access Scratch Pad areas, see "I/O Unit—Scratch Pad Commands" in Chapter 10 of the *PAC Control User's Guide*.

If you are not using PAC Control but writing your own software applications to access the Scratch Pad areas, see the *OptoMMP Protocol Guide*. This guide is written primarily for I/O units, but much of the same information on programming applies to SNAP PAC S-series controllers. The Scratch Pad areas of the memory map are described in the programming guide's appendix.

If you're communicating between an Allen-Bradley Logix-based PLC and an S-series PAC, see the *EtherNet/IP for SNAP PAC Protocol Guide*.

What's Next?

Your controller is now ready for use.

- To create PAC Control strategies to run on the controller, see the *PAC Control User's Guide* and the *PAC Control Command Reference*. Both are available in PDF format on the CD that came with the controller.
- To work with the following items on the controller, see instructions in the *PAC Manager User's Guide*:
  - Secondary and wireless network interfaces
  - File system and FTP
  - Security settings
  - Port configuration

3: Maintenance and Troubleshooting

To troubleshoot problems that may have occurred, see the section "Troubleshooting,"starting below.

For maintenance information about the SNAP PAC S-series controller, see the section "Maintaining the Controller" on page 39.

Troubleshooting

If you encounter a problem while installing or using the SNAP PAC S-series controller, check the information in this section. To contact Opto 22 Product Support, see "For Help" on page 14.

Checking Power

When troubleshooting any problem with your controller, first check that the required power is correctly supplied.

IMPORTANT: *The current version of the SNAP PAC S-series standalone controller requires* ***8–32 VDC power****,* not *the 5 VDC power used by previous SNAP controllers and controller/brains. If you are replacing an older SNAP controller or controller/brain with a SNAP PAC S-series controller, make sure that 8–32 VDC power is supplied. Note that S-series controllers with serial numbers below 500,000 use 8–24 VDC.*

1. Review the information in "Power Supply Recommendations" on page 16 and the power requirements listed in "Specifications" on page 51. Confirm that the power supply used with the SNAP PAC S-series controller meets these requirements.
2. Confirm that all leads connected to the controller and the power supply are securely attached. These connections are described in "Installing Hardware" on page 16.
3. Verify that the controller's ground terminal is connected to a known earth/chassis ground as described in "Installing Hardware" on page 16.
4. Confirm that two Phillips-head screws are installed on the wide sides of the case, one screw per side. (These screws secure and ground the controller's internal components.)

Communicating on a Wired Ethernet Network

If you attempt to connect to the controller using its IP address and you cannot, first check the following:

- Make sure the controller has been turned on, the STAT LED is lit and not blinking, and the LNK LEDs for the connected Ethernet interfaces are lit. (See LED information on pages 53 and 55.)
- Verify that you typed in the correct address for the controller. Check the label on the side of the controller, where the IP address should be written.
- Make sure the controller has been assigned a valid IP address and subnet mask. SNAP PAC S-series controllers come from the factory with a default IP address of 0.0.0.0, which is invalid. The default subnet mask is 255.255.255.0. To assign IP address and subnet mask, see the *PAC Manager User's Guide*.
- Make sure you have up-to-date drivers installed on your computer's Network Interface Card (NIC). Contact your system administrator or the manufacturer of the card for help.
- Make sure any firewall in the computer (such as the built-in firewall in Windows XP) is temporarily disabled before you try to assign or change IP addresses, load firmware using PAC Manager's Maintenance window, or work with files on the controller. BootP and FTP cannot function through a firewall in the PC. Firewalls in a router are less likely to be a problem unless certain ports (such as FTP client) have been blocked, either by default or on purpose.

Pinging the Controller

If you still cannot communicate with the controller after you have checked these items, try to reach it using the PING application.

1. Choose Start→Run and type `cmd` to open a command prompt.
2. At the prompt, type: `ping [controller's IP address]`

   For example, type: `ping 10.192.54.40`

   At this point be sure to check for other devices on the Ethernet network that may have the same IP address.

If the controller responds, go to "Maintaining the Controller" on page 39.

If the PING command cannot be found, choose Start→Control Panel→Network. Make sure TCP/IP is configured as a protocol and that an IP address and subnet mask are assigned.

If you see the message "Destination host route not defined," the controller probably has an inappropriate IP address and subnet mask. Make sure the IP address and subnet mask on the controller are compatible with those on the computer. Follow directions in the *PAC Manager User's Guide* to check the IP address and subnet mask on the controller and change them if necessary.

If you see the message "No response from host," check the following:

- Are the computer and controller correctly connected? Is the controller turned on?
- Are the IP address and subnet mask on the controller compatible with those on the computer?

- Is the controller in bootloader mode? (If the reset button is held down for too long, the controller will enter bootloader mode, which is indicated by the STAT LED blinking seven times quickly.)

If you still cannot ping the controller, contact Opto 22 Product Support. (See "For Help" on page 14 for contact information.)

Solving Network Problems

If there are recurring problems in communicating with the controller, check your network. The wires, switches, and other parts in your Ethernet network are not part of the Opto 22 hardware, but any problems in your network may affect communication with Opto 22 products.

Create a Network Diagram

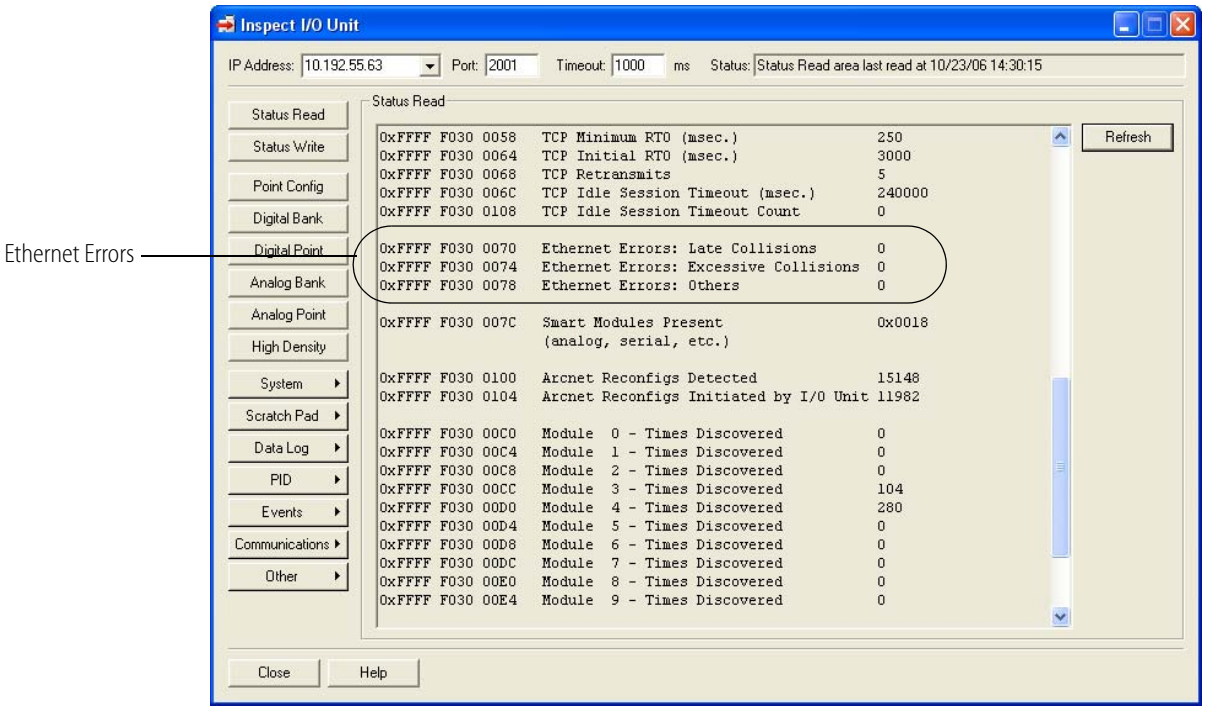
First, create a network diagram and verify the following:

- Cable connectors are firmly inserted.
- The switch has power. Switch LEDs indicate that the connection is up.
- Neither the PC nor the controller unit uses the switch's uplink port.
- The controller's LNK LED is lit.

Check Ethernet Errors

Next, use PAC Manager to check any Ethernet errors reported. These errors indicate network problems. You will need to know the controller's IP address.

1. Choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.
2. In the PAC Manager main window, click the Inspect icon .
3. In the IP Address field, type the IP address of the controllerI/O unit. Click Status Read.
4. Scroll down until you see the items Ethernet Errors: Late Collisions, Ethernet Errors: Excessive Collisions, and Ethernet Errors: Others.


Ethernet Errors
Inspect I/O Unit
IP Address: 10.192.55.63
Port: 2001
Timeout: 1000 ms
Status: Status Read area last read at 10/23/06 14:30:15
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Refresh
0xFFFF F030 0058 TCP Minimum RTO (msec.) 250
0xFFFF F030 0064 TCP Initial RTO (msec.) 3000
0xFFFF F030 0068 TCP Retransmits 5
0xFFFF F030 006C TCP Idle Session Timeout (msec.) 240000
0xFFFF F030 0108 TCP Idle Session Timeout Count 0
0xFFFF F030 0070 Ethernet Errors: Late Collisions 0
0xFFFF F030 0074 Ethernet Errors: Excessive Collisions 0
0xFFFF F030 0078 Ethernet Errors: Others 0
0xFFFF F030 007C Smart Modules Present 0x0018
(analog, serial, etc.)
0xFFFF F030 0100 Arcnet Reconfigs Detected 15148
0xFFFF F030 0104 Arcnet Reconfigs Initiated by I/O Unit 11982
0xFFFF F030 00C0 Module 0 - Times Discovered 0
0xFFFF F030 00C4 Module 1 - Times Discovered 0
0xFFFF F030 00C8 Module 2 - Times Discovered 0
0xFFFF F030 00CC Module 3 - Times Discovered 104
0xFFFF F030 00D0 Module 4 - Times Discovered 280
0xFFFF F030 00D4 Module 5 - Times Discovered 0
0xFFFF F030 00D8 Module 6 - Times Discovered 0
0xFFFF F030 00DC Module 7 - Times Discovered 0
0xFFFF F030 00E0 Module 8 - Times Discovered 0
0xFFFF F030 00E4 Module 9 - Times Discovered 0
Close
Help

All three of these items should have a value of zero. If any of these items has a value other than zero, you may have a network problem.

Analyze Communication Packets

If it appears that you have network problems, Opto 22 recommends using the open-source network protocol analyzer (or "packet sniffer") WireShark (www.wireshark.org) to log and analyze network communication packets on your network.

Have Your Network Certified

If you suspect network problems, you may need to have your network professionally certified. Opto 22 does not offer network validation or certification services, but many network hardware manufacturers do. Contact the manufacturer of your Ethernet network hardware to have them diagnose, fix, and certify your network.

If you continue to have problems communicating with the controller or I/O units after your network is certified, contact Opto 22 Product Support. (See "For Help" on page 14.)

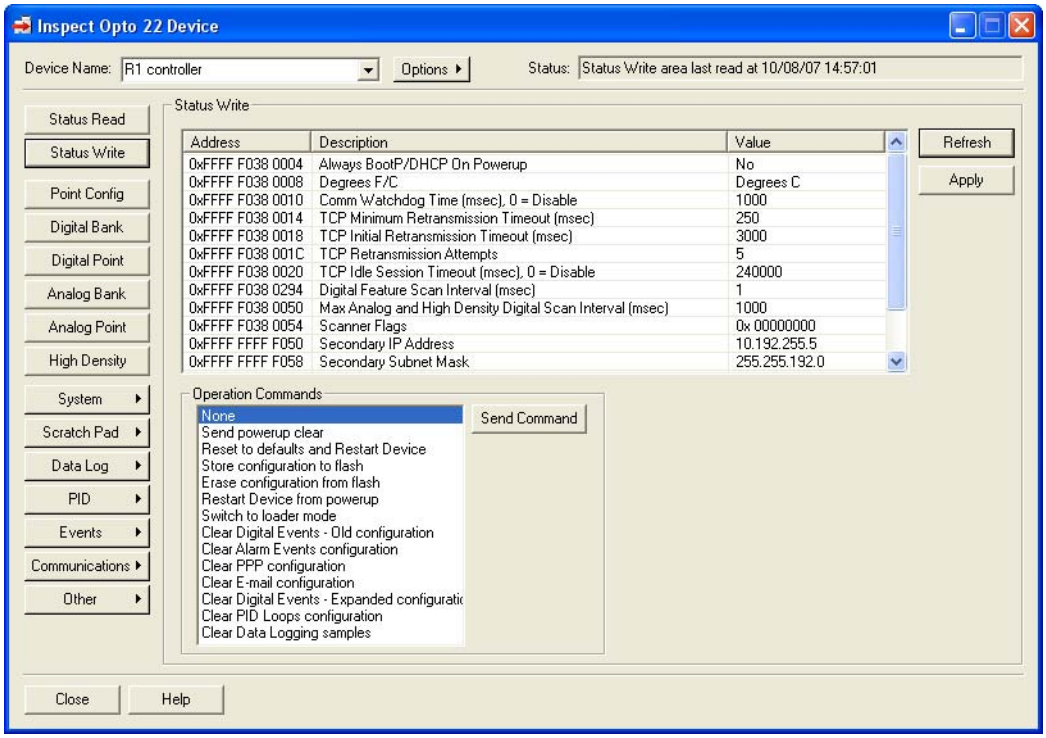
TCP Settings

Retransmit timeout (RTO) refers to the length of time the controller waits while communicating before timing out. The RTO is determined by the controller's TCP/IP stack, and the stack continually recalculates the RTO based on recent network traffic. If the network becomes busier, for example, the stack automatically adjusts the RTO to a higher value.

If the TCP/IP stack times out while trying to transmit data, it doubles the current RTO and tries again. This process continues for five retries; after that, the controller stops trying and sends a timeout message.

If you are receiving frequent timeout messages from the SNAP PAC S-series controller, you can change the TCP parameters in PAC Manager.

1. Choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.
2. In the PAC Manager main window, click the Inspect button .
3. In the IP Address field, type the IP address of the controller. Click Status Write.


Inspect Opto 22 Device
Device Name: R1 controller
Options
Status: Status Write area last read at 10/08/07 14:57:01
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Status Write
Address
Description
Value
0xFFFF F038 0004 Always BootP/DHCP On Powerup No
0xFFFF F038 0008 Degrees F/C Degrees C
0xFFFF F038 0010 Comm Watchdog Time (msec), 0 = Disable 1000
0xFFFF F038 0014 TCP Minimum Retransmission Timeout (msec) 250
0xFFFF F038 0018 TCP Initial Retransmission Timeout (msec) 3000
0xFFFF F038 001C TCP Retransmission Attempts 5
0xFFFF F038 0020 TCP Idle Session Timeout (msec), 0 = Disable 240000
0xFFFF F038 0294 Digital Feature Scan Interval (msec) 1
0xFFFF F038 0050 Max Analog and High Density Digital Scan Interval (msec) 1000
0xFFFF F038 0054 Scanner Flags 0x 00000000
0xFFFF FFFF F050 Secondary IP Address 10.192.255.5
0xFFFF FFFF F058 Secondary Subnet Mask 255.255.192.0
Refresh
Apply
Operation Commands
None
Send powerup clear
Reset to defaults and Restart Device
Store configuration to flash
Erase configuration from flash
Restart Device from powerup
Switch to loader mode
Clear Digital Events - Old configuration
Clear Alarm Events configuration
Clear PPP configuration
Clear E-mail configuration
Clear Digital Events - Expanded configurati
Clear PID Loops configuration
Clear Data Logging samples
Send Command
Close
Help

CAUTION: *Note the following recommended settings:*

TCP Minimum Retransmission Timeout (msec):	*250*
TCP Initial Retransmission Timeout (msec):	*3000*
TCP Retransmission Attempts:	*5*
TCP Idle Session Timeout (msec):	*240,000*

If you set these fields too low, you may not be able to communicate with the controller at all, even through PAC Manager, to fix the settings. Then you would have to reset the controller to factory defaults.

4. Change these four fields as necessary:

   TCP Minimum Retransmission Timeout sets an absolute minimum value for the RTO. The controller's calculated RTO will never go below this value.

TCP Initial Retransmission Timeout sets the RTO for the first communication try. Be careful: since all future tries are based on this value, if you set it too low for network conditions, a connection will never be made.

TCP Retransmission Attempts sets the number of times the controller retries communication. Larger, busier networks need a higher number of retransmits than smaller networks with less traffic.

TCP Idle Session Timeout sets how long (in milliseconds) the controller allows a session to remain open without any activity. After this time, the controller closes the unused session. The default is 240,000 milliseconds, or four minutes.

5. Click the Apply button to write your changes to the controller.
6. In the Operation Commands list, highlight Store configuration to flash. Click Send Command.
7. In the Operation Commands list, highlight Restart I/O Unit from powerup. Click Send Command.

   The new TCP parameters are set.

Communicating on a Serial Network

If a SNAP PAC S-series controller fails to connect using either an RS-232 serial interface for PPP host communication or an RS-485 serial interface for I/O unit communication, check the following:

Indicators—Depending on the port(s) being used on a SNAP-PAC-S1 controller, LED S0, S1, or S2 should be red (for receive data) and green (for transmit data). On a SNAP-PAC-S2, there are separate LEDs for Transmit and Receive for each port. Green indicates activity.

Power—Make sure that both the controller and the device it is connected to have been turned on.

Physical Connections—Check that the connectors on each end of the serial link are firmly attached to the controller and the other connected device.

RS-232 Configuration—RS-232 communication on a SNAP PAC S-series controller is configured using PAC Manager software, and ports must be configured correctly for their use, or they won't work. See "Configuring Direct Communication to Serial Devices" in the *PAC Manager User's Guide*.

NOTE: Port 0 is set by default to communicate using PPP. If you're connecting to serial devices with Port 0, you must change its configuration in PAC Manager.

RS-485 Configuration—On a SNAP-PAC-S1, RS-485 serial network bias and termination are configured using DIP switches on the top of the unit. Confirm that DIP switches are set to the correct positions for the controller's location in the RS-485 network. See "RS-485 Connections" on page 18 for information. On a SNAP-PAC-S2, all port configuration is performed using PAC Manager. See the *PAC Manager User's Guide*, form 1704.

Maintaining the Controller

Backup Battery

SNAP-PAC-S1 controllers have a user-replaceable 3.6-volt TL 5242 /W lithium battery that will retain data for a minimum of 10 years. Replacement part number is G4BATT32.

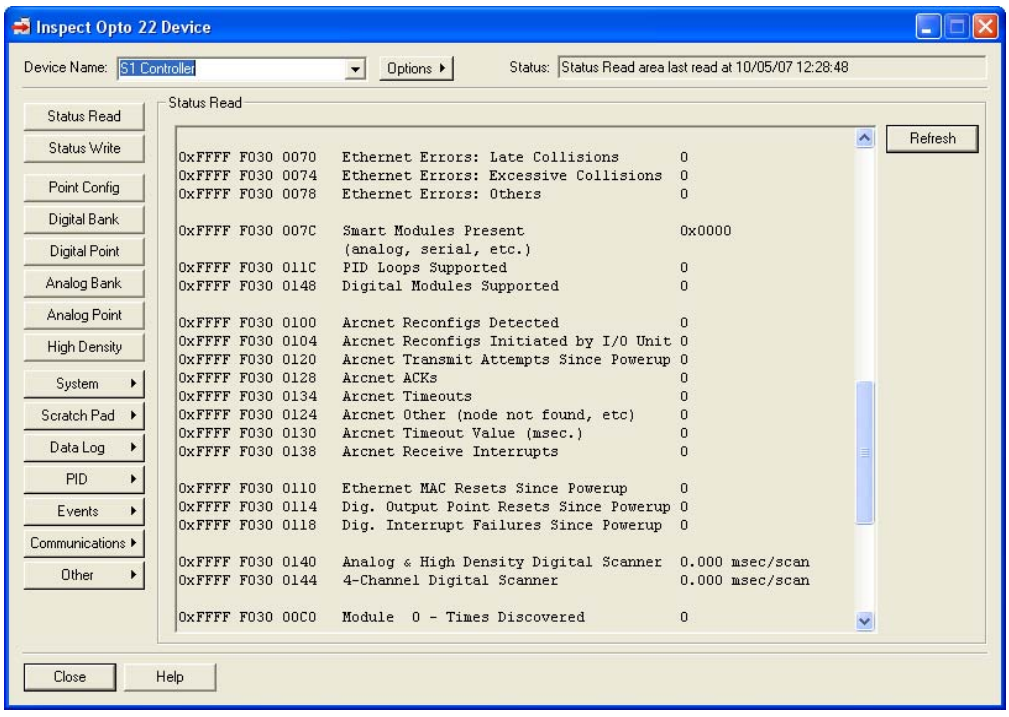
SNAP-PAC-S2 controllers have a rechargeable battery that receives charging current whenever the brain has power. It will retain data for up to one year with the power off.

Getting Device and Firmware Information

If you need to contact Opto 22 Product Support for assistance in using a controller, it is helpful to have device and firmware information at hand before you call.

1. Choose Start→Programs→Opto 22→PAC Project Software→PAC Manager.
2. In the PAC Manager main window, click the Inspect button .
3. In the IP Address field, type the IP address of the device. Click Status Read.

   This example shows a SNAP-PAC-S1; other devices are similar.


Inspect Opto 22 Device
Device Name: S1 Controller
Options
Status: Status Read area last read at 10/05/07 12:28:48
Status Read
Status Write
Point Config
Digital Bank
Digital Point
Analog Bank
Analog Point
High Density
System
Scratch Pad
Data Log
PID
Events
Communications
Other
Status Read
Refresh
0xFFFF F030 0070 Ethernet Errors: Late Collisions 0
0xFFFF F030 0074 Ethernet Errors: Excessive Collisions 0
0xFFFF F030 0078 Ethernet Errors: Others 0
0xFFFF F030 007C Smart Modules Present 0x0000
(analog, serial, etc.)
0xFFFF F030 011C PID Loops Supported 0
0xFFFF F030 0148 Digital Modules Supported 0
0xFFFF F030 0100 Arcnet Reconfigs Detected 0
0xFFFF F030 0104 Arcnet Reconfigs Initiated by I/O Unit 0
0xFFFF F030 0120 Arcnet Transmit Attempts Since Powerup 0
0xFFFF F030 0128 Arcnet ACKs 0
0xFFFF F030 0134 Arcnet Timeouts 0
0xFFFF F030 0124 Arcnet Other (node not found, etc) 0
0xFFFF F030 0130 Arcnet Timeout Value (msec.) 0
0xFFFF F030 0138 Arcnet Receive Interrupts 0
0xFFFF F030 0110 Ethernet MAC Resets Since Powerup 0
0xFFFF F030 0114 Dig. Output Point Resets Since Powerup 0
0xFFFF F030 0118 Dig. Interrupt Failures Since Powerup 0
0xFFFF F030 0140 Analog & High Density Digital Scanner 0.000 msec/scan
0xFFFF F030 0144 4-Channel Digital Scanner 0.000 msec/scan
0xFFFF F030 00C0 Module 0 - Times Discovered 0
Close
Help

Keep this window open on your screen when you call Product Support. See the note on the next page.

NOTE: Because the Status Read area is used for both standalone controllers and Ethernet-based I/O units, some items apply to some devices and not others. The following items do not apply to standalone controllers:

Degrees F/C
Comm Watchdog Time (msec.)
Scanner Flags
Digital Scan Counter
Analog Scan Counter
PID Loops
Smart Modules Present
Arcnet data
Digital resets and failures since powerup

For detailed information about items in the Status Read area, see the PAC Manager User's Guide.

Changing the Controller's IP Address

If you know the SNAP PAC S-series controller's IP address, see the *PAC Manager User's Guide* for instructions to change it.

If you do not know the IP address, first check the label on the side of the controller in case the IP address has been written there. If you still don't know the controller's IP address, reset the controller to factory default settings following the instructions in "Resetting the Controller" on page 40 and then set the IP address as described in the *PAC Manager User's Guide*.

Resetting the Controller

1. Carefully insert a straightened paperclip or stiff wire into the small hole labeled RESET.
2. Press and hold down the RESET button as described below.

CAUTION: Do not power on the controller while holding down the Reset button. This will deactivate battery power which will cause the loss of contents in battery-backed RAM and stop the real-time clock.

To perform this kind of reset...	...do this...	Result
Simple reset	Quickly press and release the RESET button. **or** Cycle power to the controller. **or** Use PAC Manager to send the controller the "Restart from Power-up" command.	The controller restarts. Any files, strategy, and archived strategy in RAM are erased. If these items have been stored to flash memory, they will not be erased.

To perform this kind of reset...	...do this...	Result
Restore the factory default settings.	Press and hold the RESET button for approximately 1 sec until the STAT LED turns solid green, and then immediately release the button.	The controller restarts. Any files, strategy, archived strategy, and persistent variables in RAM and flash memory are erased. IP addresses are reset to 0.0.0.0 and subnet masks to 255.255.255.0.

CAUTION: *Do not hold the RESET button too long. If you hold it down longer than five seconds, the controller will enter hardware test mode, which is indicated by the STAT LED blinking orange, rapidly and continuously. Hardware test mode erases all files in RAM and flash memory and resets the IP address. If your controller restarts in hardware test mode, cycle power; the result will be same as restoring factory default settings (see table above).*

If you hold down the RESET button less than five seconds but longer than the time needed to restore the factory default settings, the controller will restart in failsafe bootloader mode. This mode is indicated by the STAT LED: in loader versions older than 5.1c, it blinks green 7 times quickly; in loader 5.1c and newer, it blinks red/green continuously. Failsafe bootloader mode is a diagnostic mode that you don't need to access unless you are troubleshooting a problem with Opto 22 Product Support. If your controller restarts in failsafe bootloader mode, cycle power to the device. This performs the simple reset described above and leaves the controller ready to load a new strategy.

Loading New Firmware

Each SNAP PAC S-series controller contains firmware (sometimes referred to as the *kernel*), which is similar to an operating system. If the firmware should become damaged, or if a new version of the firmware is released, you can load new firmware to the controller following instructions in the *PAC Manager User's Guide*.

Using the MicroSD Card

SNAP PAC controllers manufactured in November 2008 and later have a microSD card slot in the top of the controller's case. Cards up to 2 GB capacity with the microSD logo (shown at right) can be used in this slot. Cards with more than 2 GB capacity may fit in the slot, but the controller will not recognize them.
Do not use microSD-HD cards.

Using the microSD card with FTP, you can read the card at 380 kB/s and write to it at 231 kB/s.

The microSD card can be used for several purposes:

- To store data or files, which you can access using PAC Control commands or an FTP client. (PAC Manager cannot be used to access data, because it cannot see the card's directory.)

- To update firmware on the controller. The card provides a convenient way to update firmware on non-networked controllers. It's also useful if PAC Manager is not available to update firmware.
- To boot the controller from firmware on the microSD card rather than from the firmware in the controller, for example to test new firmware.
- To update, run, or test new PAC Control strategies if the controller is not on the network, if PAC Control isn't available, or if you want to test a new strategy without erasing the existing one.

Card Type and Format

Use only cards with the microSD logo (shown above right) with 2 GB or smaller capacity. Cards come properly formatted with FAT16 from the factory. If you ever need to reformat a card, make sure to use a utility specifically designed to format SD cards, and use FAT16.

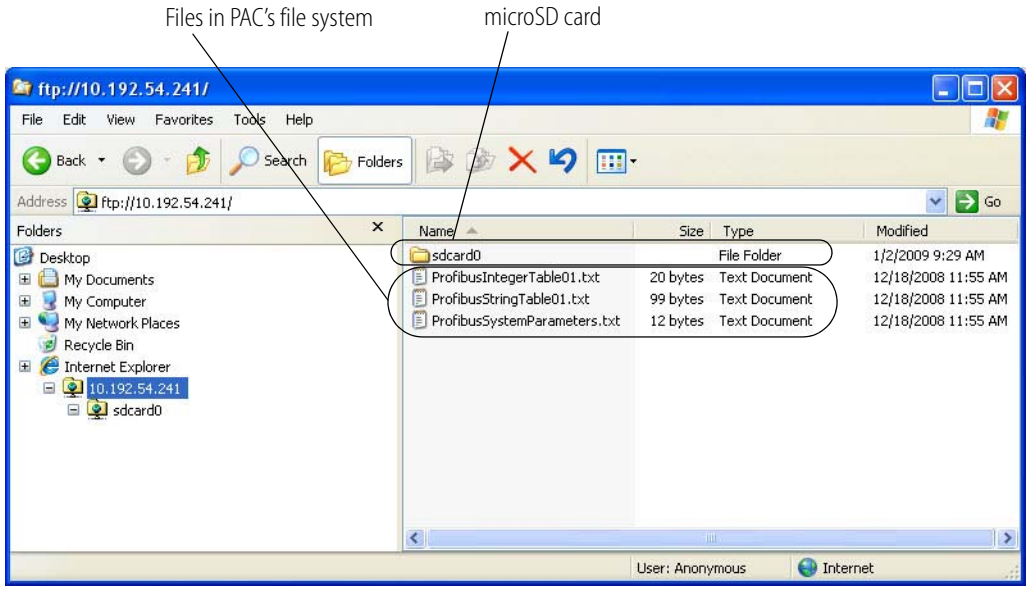
Since long filenames are not supported, all files you store on the card must be named with a maximum of eight characters in the name plus three characters in the extension (8 dot 3 format), for example: `datafile.txt`

Storing and Accessing Data or Files

When inserted into the controller and accessed via FTP or PAC Control, the card appears as a directory in the controller's file system named: `sdcard0`

IMPORTANT: *Do NOT create this directory. When you look at the card in the controller, the directory automatically appears. When you look at the card in a card reader attached to your PC, the directory does not appear, but it is still there.*

For example, suppose you are looking at a microSD card in a SNAP PAC controller with IP address 10.192.54.241. You can see that this controller has three files in its regular file system, plus the microSD card:



Within the `sdcard0` directory, you can create other directories and files as needed, up to a maximum of 512 in the sdcard0 directory. In subdirectories of sdcard0, however, you can include many more files. The total number of files and directories on the micoSD card cannot exceed 65,500.

When the card is in the controller, you can access files on the card through PAC Control commands and from a PC using FTP.

Use PAC Control commands just as you would with any other file in the controller's file system. See the section "Using the Control Engine's File System" in Chapter 10 of the *PAC Control User's Guide* (form #1700) for help. Remember to include the card's directory name in the path in the file communication handle, for example: `file:a,/sdcard0/VoltLog.txt`

You can also use the FTP communication handle in PAC Control to manipulate files. See the section "Moving Files via FTP," also in Chapter 10 of the *PAC Control User's Guide*.

To move files to or from a PC, use any standard FTP software. (Don't use PAC Manager as the FTP client, as it cannot see directories within the controller's file system). Remember to include the card's directory name, for example: `ftp://192.168.1.1/sdcard0/`

When the microSD card is in the controller, the STAT LED blinks briefly about once every five seconds, indicating that the controller has scanned it and knows it is there.

NOTE: If you access the card when it is not in the controller (for example, if it is in a card reader), the sdcard0 *directory does not appear. Do NOT create it. It automatically appears when the card is in the controller.*

Displaying Free Space on the Card

(Requires firmware 8.5a or newer.) If you need to know how many free bytes are left on a microSD card, you can use PAC Control or PAC Manager to read this data from an address in the controller's memory map. In a PAC Control strategy, for example, you could notify an operator if the card needs replacing, based on the number of bytes still unused.

1. Make sure the card is in the controller.
2. In PAC Control, use the command Read Number from I/O Unit Memory Map to read memory map address FFFFF7002204. Use Integer 32 Variable in Argument 2.

   For more information, see "I/O Unit—Memory Map Commands" in Chapter 10 of the *PAC Control User's Guide,* and see "Read Number from I/O Unit Memory Map" in the *Command Reference* or Help.)
3. In PAC Manager, open the Inspect window for the controller. Click Other and choose Generic Read/Write from the popup menu. In the Address field, type F7002204. From the Type dropdown list, choose 32-bit Integer. Leave the Length as 1. Click Refresh.

   The number of bytes appears in the Value column.

Updating Firmware

The card can also be used to update firmware if the controller is not on the network, or if PAC Manager isn't available.

NOTE: The controller must have firmware version R8.4a or higher and loader version 5.1b or higher to use the microSD card in this way.

1. Obtain the correct firmware file from our website, www.opto22.com. If you are using Secure Strategy Distribution (SSD), the firmware must have the correct signature.
2. Rename the firmware file to fit the 8 dot 3 filename format (see "Card Type and Format" on page 42).

   The original file extension does not have to be retained. To make sure the file is clearly identified, we recommend a name such as the following: `PPP-TMM.mmb` where:

   PPP = controller type (R1, R2)
   T = R for release (or B for beta)
   MM = major revision number
   mm = minor revision number
   b = build letter

   Example of a recommended firmware filename: `R2-R8.4a`
3. Copy the renamed firmware files to the card.

   You can write to the card in one of two ways: either use your PC to FTP files to the card in the controller, or use a card reader with your PC and simply copy files with Windows Explorer.
4. In the root directory of the card, create a command file named `command` (If you are looking at the card in a card reader, you are in the root directory. If you are looking at the card in the controller, the root directory is `sdcard0`)
5. In the `command` file, include the following command. All commands are CASE SENSITIVE.

To do this	Use command	Details
Install controller firmware	`Krn <file>`	<file> is the firmware path and filename as the microSD card sees it, so do not include *sdcard0* directory in the path. The firmware file can be compressed in gzip format or uncompressed.* If you're using Secure Strategy Distribution, <file> must include a valid signature. NOTE: Controller firmware will be installed only if it differs from the current firmware.
* To gzip a file on Windows, use the utility at http://gnuwin32.sourceforge.net/packages/gzip.htm. SNAP PAC cannot decompress files that were compressed with WinZip		

   The following sample command file updates firmware on the controller.

```
Krn R1-R8.4a
```

6. To update firmware, insert the card in the controller's card slot.

   The controller reads the command file, updates firmware, and saves controller firmware to flash memory. When finished, it places a file named `response` in the root directory of the card; this file indicates the success or failure of each command. Then the controller restarts.
7. After the controller restarts, remove the card.

Booting from Firmware on the Card

You can also boot the controller from firmware on the card, rather than from the firmware in flash memory, for example to test new firmware before updating it.

You can write to the card in one of two ways: either use your PC to FTP files to the card in the controller, or use a card reader with your PC and simply copy files with Windows Explorer.

NOTE: The controller must have loader version 5.1b or higher. Controllers configured for Secure Strategy Distribution (SSD) cannot boot from the card.

1. Locate the firmware file you wish to boot from and rename it to fit the 8 dot 3 filename format (see "Card Type and Format" on page 42).

   Recommended naming scheme: `PPP-TMM.mmb` where:

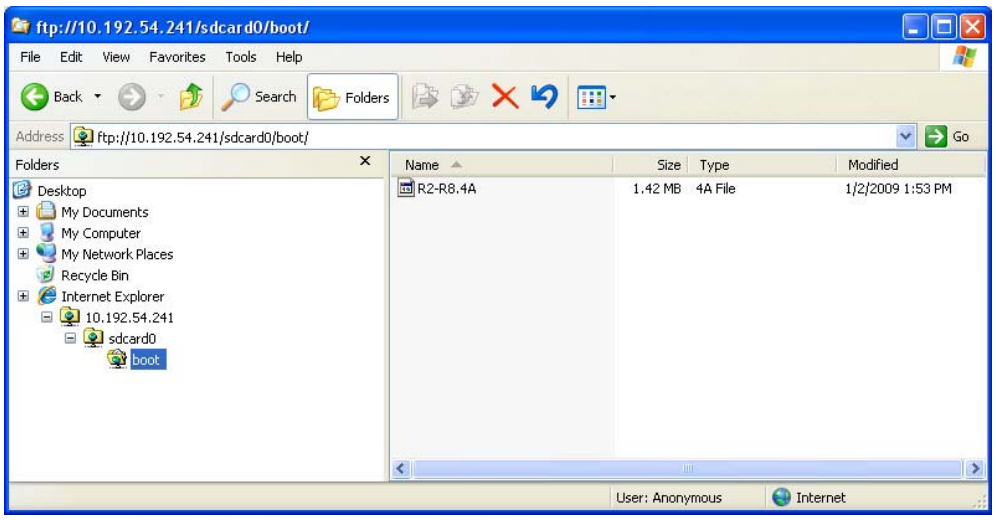
   PPP = controller type (R1, R2)
   T = R for release (or B for beta)
   MM = major revision number
   mm = minor revision number
   b = build letter

   Example of a recommended firmware filename: `R2-R8.4a`

2. Create a directory on the card in the root and name it: `boot`

   Remember, if you are looking at the card *in the controller*, you create the `boot` directory in the `sdcard0` directory. If you are looking at the card *in a card reader*, create the `boot` directory at the top level. You can't see the `sdcard0` directory, but it is still there.

3. Copy the renamed firmware file to the `sdcard0/boot` directory on the microSD card (see the following graphic).



***IMPORTANT**: The boot directory must contain only one firmware file. If it contains more than one, the wrong firmware may be loaded.*

4. To boot the controller from firmware on the card, turn the controller off and insert the card in the controller's card slot. Turn the controller back on. (Or insert the card and immediately reset the controller.)

   If the boot directory exists on the card, the STAT LED blinks green three times, quickly. Firmware is loaded. If the STAT LED blinks red, see "Blink Codes" in this chapter to determine the problem.

   If the STAT LED blinks green two times, either the boot directory is not present, the firmware file is invalid or does not match the controller, or the controller is an SSD controller.

5. When the STAT LED no longer blinks steadily, but blinks only once every five seconds, remove the card.

   When the card is removed, the controller continues running the firmware on the card until power is cycled or the controller is reset. If you need to know whether the controller booted from the card or from Flash memory, use PAC Manager's Inspect window to check the Status Read area. See the *PAC Manager User's Guide* for instructions.

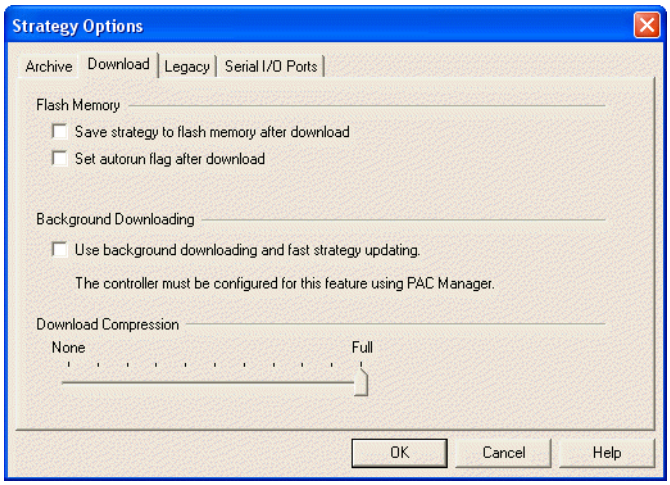
Updating, Running, or Testing a Strategy

The card can also be used to update, run, or test a PAC Control strategy. This ability is useful when the controller is not on the network or PAC Control isn't available. Both regular strategies and Secure Strategy Distribution (SSD) strategies can be used.

You can write to the card in one of two ways: either use your PC to FTP files to the card in the controller, or use a card reader with your PC and simply copy files with Windows Explorer.

NOTE: The controller must have firmware version R8.4a or higher and loader version 5.1b or higher.

1. In PAC Control Configure mode, double-click the name of the control engine in the Strategy Tree (or choose File→Strategy Options). Click the Download tab.



2. Check the boxes if you want to save the strategy to flash memory and/or autorun it. If you are just testing the strategy, don't save it to flash.

   Autorun works if you insert the card and then turn on the controller; it has no effect if you insert the card when the controller is already turned on. (If the controller is already turned on, the new

strategy follows the status of the existing strategy: if the existing strategy was running when the card was inserted, the new strategy will run; otherwise, it will not.)

If you use background downloading, the controller will switch to the new strategy when the card is inserted.

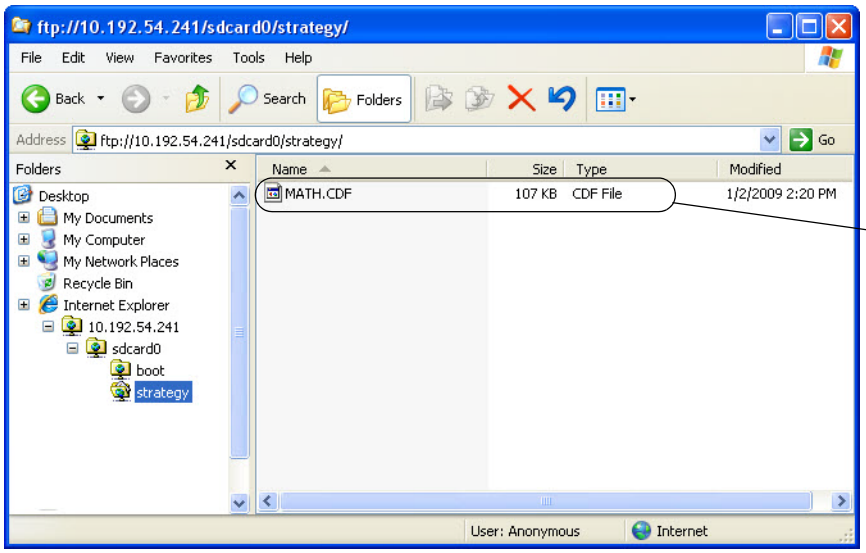
3. Choose one of the following:
   a. If you're using Secure Strategy Distribution, follow steps in form #1762, the *PAC Terminal SSD Technical Note*, to create a download file with the file extension .ssd.
   b. Otherwise, compile the strategy as a Control Engine Download file (.cdf) by right-clicking the name of the control engine in the Strategy Tree and choosing Compile Control Engine Download File from the pop-up menu.

      The file is created in the same folder as the strategy, with a .cdf extension and a filename consisting of the strategy's name and the control engine's name (for example, MyStrategy.MyEngine.cdf).
4. Rename the .cdf or .ssd strategy file to fit the 8 dot 3 filename format for the microSD card (see "Card Type and Format" on page 42).

   ***IMPORTANT**: You must retain the correct file extension (.cdf or .ssd).*
5. Create a directory on the card in the root and name it: `strategy`

   Remember, if you are looking at the card *in the controller*, you create the `strategy` directory in the `sdcard0` directory. If you are looking at the card *in a card reader*, create the `strategy` directory at the top level. You can't see the `sdcard0` directory, but it is still there.
6. Copy the renamed strategy file to the `sdcard0/strategy` directory on the microSD card.

   Here's an example of a strategy file in the strategy directory:



7. Choose how you want to use the card with the controller:
   a. **Turn off the controller, put the card in, and turn the controller back on.** The controller will load the strategy from the card (verifying the signature if it is an .ssd file), burn the strategy to flash if you told it to do so, switch to the new strategy if you're using

background downloading, and run the new strategy if you set it to autorun. If it's not set to autorun, you can start the strategy manually.

b. Put the card in while the controller is running. The controller will check that the stratregy differs from the existing one, verify signature on an .ssd file, load the strategy, burn it to flash if you told it to, switch to the new strategy if you're using background downloading, and then run the strategy only if the existing strategy was running when you put the card in. If the existing strategy was stopped, the new one will not run; you can start it manually.

In either case, the STAT LED will blink steadily while the strategy is loading and then blink three times—green to indicate success, or red to indicate failure.

8. When the STAT LED no longer blinks steadily, but blinks only once every five seconds, remove the card.

Disabling or Enabling Firmware and Strategy Updates Via the Card

If you do not want anyone to be able to update firmware or strategies using a microSD card, you can disable this feature in the controller.

1. In PAC Manager, open the Inspect window for the controller.
2. Click Other and choose Generic Read/Write from the popup menu.
3. In the Address field, type F7002200. Choose 32-bit Integer as the Type.
4. To disable firmware/strategy updates: In the Value column next to the address, type 0 (zero). Click Refresh.
5. To enable firmware/strategy updates: In the Value column, type any value other than zero.

Setting Time and Date

The SNAP PAC S-series controller's built-in clock is set at the factory. To change the time and date, see the instructions in the *PAC Manager User's Guide*.

STAT LED Blink Codes

The STAT LED on the top of the SNAP PAC S-series controller uses blink codes to indicate controller operation and status conditions. The blink codes can be useful during operation and in troubleshooting. When the STAT LED is on and remains green, it indicates that a flowchart is running and a user task is being executed. When the STAT LED is on and remains orange, it indicates that the controller is running, but no flowchart is running.

Different blink codes can occur in sequence. For example, two fast green blinks followed by three slow red blinks show the firmware loading at startup followed by a firmware error.

If the STAT LED blinks green when the controller starts up, it indicates the following:

Number of Blinks	Speed of Blinks	Means
2	fast	Loading firmware (kernel) from Flash memory to SDRAM.
5	fast	Default settings have been successfully restored.
7	fast	(Loader versions 5.1n and older) Entering failsafe boot-loader mode (see "Resetting the Controller" on page 40).

If the STAT LED is blinking orange, it indicates the following:

Number of Blinks	Speed of Blinks	Means
(continuous)	slow	There is a problem with the bootloader. Contact Product Support.
(continuous)	fast	No IP address is assigned to the controller. This may also indicate the controller is in hardware test mode.

If the STAT LED blinks red and green alternately, it indicates the following:

Number of Blinks	Speed of Blinks	Means
(continuous)	fast	(Loader versions 5.1c and newer) Entering fail-safe boot-loader mode. (See "Resetting the Controller" on page 40.)

If the STAT LED is blinking red, it indicates the following:

Number of Blinks	Speed of Blinks	Means	Problem and Workaround
2	slow	Flash programming failure	Flash chips failed to erase properly or program properly. Contact Product Support.
3	slow	Firmware CRC check failed.	The firmware in the device is damaged. See Replacing Damaged Firmware in chapter 6 of the *PAC Manager User's Guide*, form 1704.
4	slow	Invalid MAC address or hardware revision.	Contact Product Support.
5	slow	Fatal error	Firmware or hardware problem. Check the power supply and connections before restarting. Call Product Support if the error is repeated.
6	slow	RAM error	Contact Product Support.
7	slow	Loader problem	Firmware or hardware problem. Confirm Ethernet cables are connected. Try turning off power to the controller and turning it back on again. Call Product Support if the error is repeated.
11	slow	Firmware failed to initialize communications on ENET 1.	Contact Product Support.

Number of Blinks	Speed of Blinks	Means	Problem and Workaround
12	slow	Firmware failed to initialize communications on ENET 2.	Contact Product Support.
13	slow	Realtime clock failure	Contact Product Support.

Serial Port LEDs

The S0, S1, and S2 LEDs on a SNAP-PAC-S1 controller indicate serial port operation as follows:

- **Green**—Transmit
- **Red**—Receive
- **Amber**—Transmit and Receive (the LED is actually changing rapidly between green and red, which appears amber)

Each serial port on a SNAP-PAC-S2 has two green LEDs to indicate Transmit and Receive activity for that port.

WLAN LED (Wired+Wireless Models Only)

The WLAN LED on a SNAP-PAC-S1-W or SNAP-PAC-S2-W indicates wireless LAN status and activity.:

Color of LED	Means
Red	The controller is disconnected from the wireless LAN.
Orange	The wireless LAN interface is scanning, associating, and authenticating the wireless network.
Green	The controller is connected to the wireless network.
Blinking green	Wireless LAN activity

A: Technical Specifications

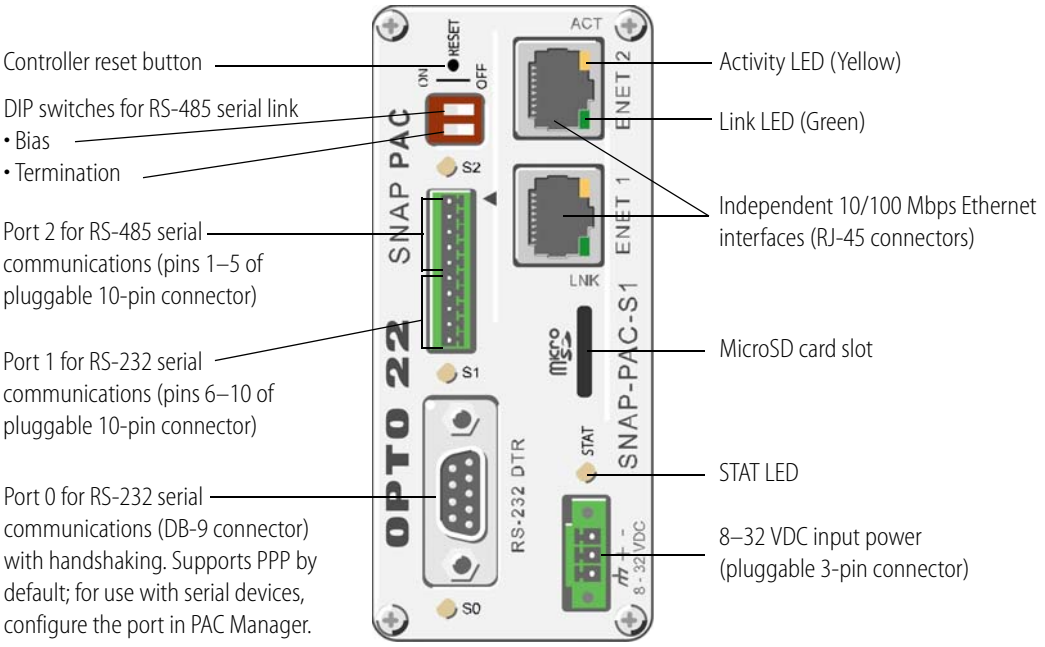
Specifications

Processor	266 MHz 32-bit ColdFire® 5475 with integrated floating-point unit (FPU)
Memory Total RAM Battery-backed RAM Flash	 128 MB (16 MB available for PAC Control strategy) 8 MB 16 MB (7.5 MB available for PAC Control strategy; 4 MB available for file storage)
Removable storage	(Models manufactured November 2008 and later; requires firmware R8.4 or higher) MicroSD card slot: supports MicroSD card up to 2 GB maximum
Backup battery	SNAP-PAC-S1: User-replaceable 3.6-volt TL 5242 /W lithium, 10-year minimum power-off data retention (replacement part number: G4BATT32) SNAP-PAC-S2: Rechargeable (recharges whenever the brain has power), 1-year power-off data retention
Ethernet Communication (wired) to host and I/O	Two independent 10/100 Mbps Ethernet network interfaces (RJ-45 connectors). Each interface has a separate IP address (separate subnet).
Ethernet Communication (wireless)* Topologies Security Frequency 802.11a Frequency 802.11b/g Transmit Power Antenna Connector Roaming	Wireless LAN interface with separate IP address. Infrastructure, Ad-Hoc 802.11i: AES - Compatible with WPA2 Personal, TKIP - Compatible with WPA Personal, WEP. Note: TKIP/AES security is not supported in Ad-Hoc mode. 5.180–5.240 GHz, 5.745–5.825 GHz 2.412–2.472 GHz, 2.484 GHz 15 dBm maximum Reverse polarity SMA (RP-SMA or RSMA) Supported within an SSID (Service Set Identifier) only
Serial Communication Range (serial multidrop) SNAP-PAC-S1 RS-232 serial RS-485 serial	 32 stations maximum on a segment (including PC, controller, repeaters, and I/O units); up to 3000 ft (914 m) on a segment Two RS-232 serial ports (one DB-9 and one pluggable connector); one port has full handshaking. PPP is supported only on port 0. One RS-485 serial port (pluggable connector); two-wire RS-485; optional *mistic* signal interrupts

SNAP-PAC-S2	Four serial ports that can be used as general purpose ports or for serial I/O units; each port is software configurable as either RS-232 (Tx, Rx, COM, DTR, DCD, RTS, CTS) or as RS-485 (2-wire, 4-wire, optional termination, optional biasing); optional *mistic* signal interrupts
I/O unit compatibility Ethernet-based I/O units Serial-based I/O units	 Opto 22 SNAP PAC R-series, SNAP PAC EB-series, SNAP SIO, SNAP EIO, and SNAP UIO brains SNAP PAC SB-series, Serial B3000, SNAP-BRS, B100/B200, *mistic* remote bricks (G4D16R, G4D32RS, G4A8R)
Power requirements	8–32 VDC ±0.5, 11.3 VA maximum (SNAP-PAC-S1 controllers with serial numbers below 500,000 use 8–24 VDC)
Operating temperature Storage temperature Humidity	0 ^{O}C to 60 ^{O}C -40 ^{O}C to 85 ^{O}C 0% to 95% relative humidity, non-condensing
Software PAC Project Basic PAC Project Professional	 Includes programming, HMI software, and configuration software; included with purchase of controller. PAC Project Basic plus OPC 2.0-compliant OPC server, OptoControl strategy and OptoDisplay project importing, support for serial *mistic* I/O units, and Ethernet link redundancy support.
Other features	Multiple protocol support including TCP/IP, FTP, SNMP v2.0c (with firmware 8.2a), Modbus/TCP, EtherNet/IP™, and OptoMMP™. Real-time clock FTP server/client with file system (in RAM and in removable storage) Ethernet link redundancy or network segmenting
Agency certifications	(-W models only) U.S., FCC Part 15 Subpart C; Canada, IC RSS-210 (-FM models only) Factory Mutual approved

* Requires a Wired+Wireless model (SNAP-PAC-S1-W or SNAP-PAC-S2-W)

SNAP-PAC-S1 and -FM Connectors, Indicators, and Pinouts



Status and Activity LEDs

Indicator	Description
S0	RS-232 serial activity on port 0
S1	RS-232 serial activity on port 1
S2	RS-485 serial activity
STAT	Startup status and control program operational status
ACT	Ethernet network activity
LINK	Link established with Ethernet network

Port 0 for RS-232 serial (DB-9 connector)

Pin	Description	Signal Direction
1	DCD	In
2	RX	In
3	TX	Out
4	DTR	Out
5	COM	
6	DSR	In
7	RTS	Out
8	CTS	In
9	RI*	In

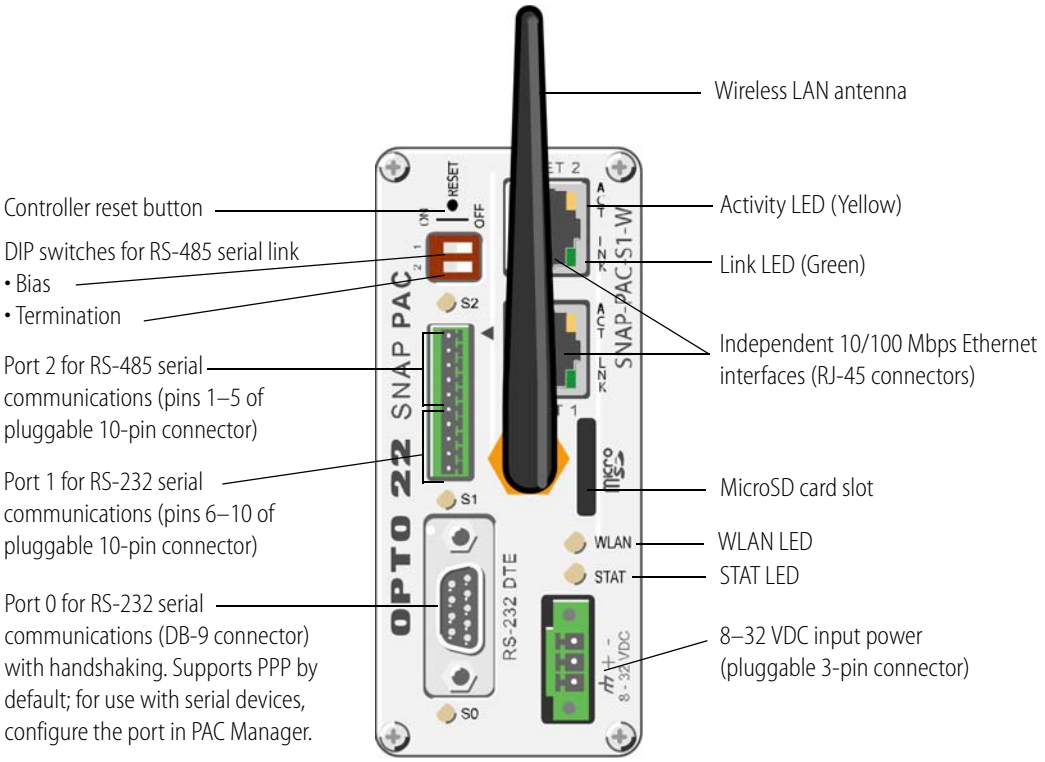
* RI signal does not occur on PACs with a microSD card slot

Ports 1 and 2 for RS-485 and RS-232 serial

	Pin	Description	Signal Direction
Port 2 for RS-485 serial (2-Wire)	1	TX/RX+	In/Out
	2	TX/RX–	In/Out
	3	SIG COM*	
	4	IRQ+	In
	5	IRQ–	In
Port 1 for RS-232 serial	6	TX	Out
	7	RX	In
	8	GND	
	9	RTS	Out
	10	CTS	In

* Isolated ground

SNAP-PAC-S1-W Connectors and Indicators (Wired+Wireless)


Wireless LAN antenna
Controller reset button
DIP switches for RS-485 serial link
• Bias
• Termination
Port 2 for RS-485 serial communications (pins 1–5 of pluggable 10-pin connector)
Port 1 for RS-232 serial communications (pins 6–10 of pluggable 10-pin connector)
Port 0 for RS-232 serial communications (DB-9 connector) with handshaking. Supports PPP by default; for use with serial devices, configure the port in PAC Manager.
Activity LED (Yellow)
Link LED (Green)
Independent 10/100 Mbps Ethernet interfaces (RJ-45 connectors)
MicroSD card slot
WLAN LED
STAT LED
8–32 VDC input power (pluggable 3-pin connector)
OPTO 22 SNAP PAC
SNAP-PAC-S1-W
RESET
ON
OFF
S2
S1
S0
RS-232 DTE
WLAN
STAT
8 - 32 VDC

Status and Activity LEDs

LED	Description
S0	RS-232 serial activity on port 0
S1	RS-232 serial activity on port 1
S2	RS-485 serial activity
STAT	Startup status and control program operational status
ACT	Ethernet network activity
LINK	Link established with Ethernet network
WLAN	Wireless LAN status

Port 0 for RS-232 serial (DB-9 connector)

Pin	Description	Signal Direction
1	DCD	In
2	RX	In
3	TX	Out
4	DTR	Out
5	COM	
6	DSR	In
7	RTS	Out
8	CTS	In
9	NC*	

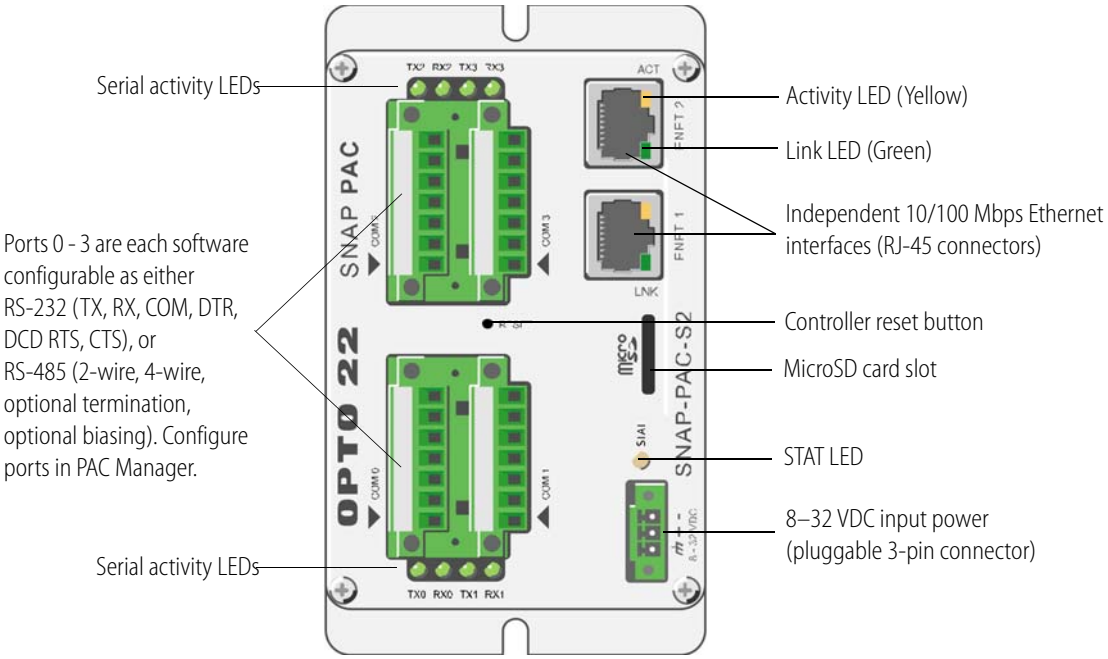
* No connection

Ports 1 and 2 for RS-485 and RS-232 serial

	Pin	Description	Signal Direction
Port 2 for RS-485 serial (2-Wire)	1	TX/RX+	In/Out
	2	TX/RX–	In/Out
	3	SIG COM*	
	4	IRQ+	In
	5	IRQ–	In
Port 1 for RS-232 serial	6	TX	Out
	7	RX	In
	8	GND	
	9	RTS	Out
	10	CTS	In

* Isolated ground

SNAP-PAC-S2 Connectors, Indicators, and Pinouts


Serial activity LEDs
Ports 0 - 3 are each software configurable as either RS-232 (TX, RX, COM, DTR, DCD RTS, CTS), or RS-485 (2-wire, 4-wire, optional termination, optional biasing). Configure ports in PAC Manager.
Serial activity LEDs
Activity LED (Yellow)
Link LED (Green)
Independent 10/100 Mbps Ethernet interfaces (RJ-45 connectors)
Controller reset button
MicroSD card slot
STAT LED
8–32 VDC input power (pluggable 3-pin connector)
SNAP PAC
OPTO 22
SNAP-PAC-S2
ACT
LNK

RS-485 and RS-232 Ports[1]

Pin	RS-232	Signal Direction	RS-485	Signal Direction
1	TX	Out	TX/RX+	In/Out
2	RX	In	TX/RX–	In/Out
3	COM[2]		COM[2]	
4	RTS	Out	RX+ (4 wire)	In
5	CTS	In	RX- (4 wire)	In
6	DTR	Out	IRQ+	In
7	DCD	In	IRQ–	In

[1] **CAUTION**: **Do not use communication port connectors from a legacy OptoControl controller***. Legacy connectors will fit in a SNAP-PAC-S2, but the pin orientation is different. Instead, use the connectors supplied with the SNAP-PAC-S2 controller.

[2] Isolated ground. (Each channel is isolated from the others.)

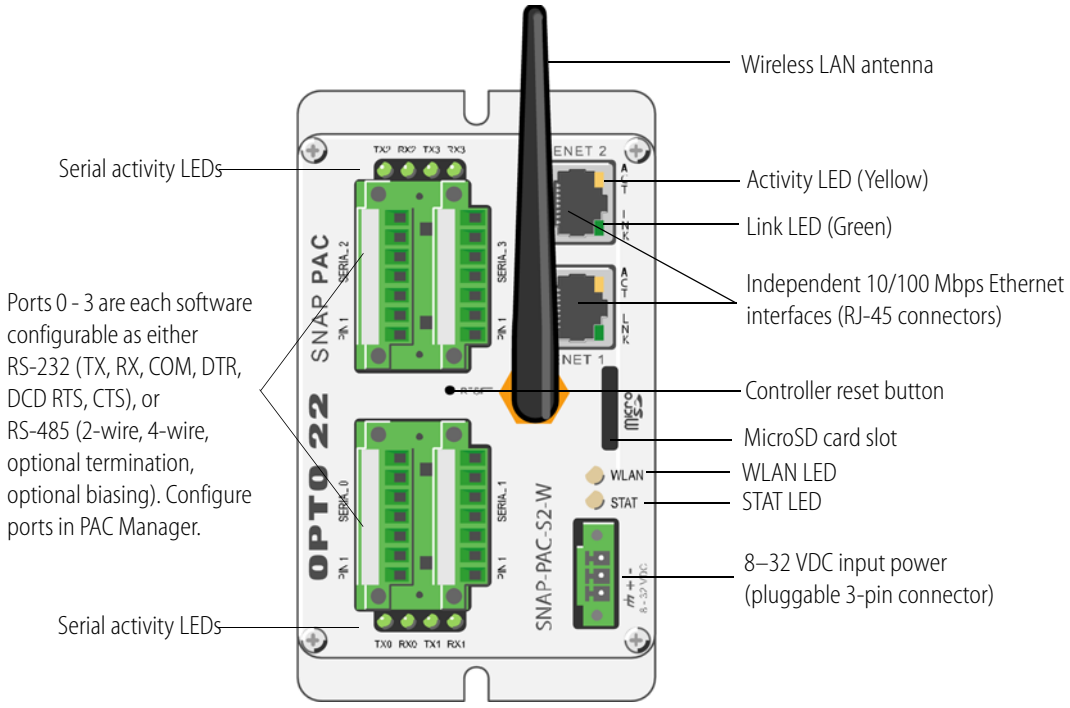
*Legacy OptoControl Controllers:

G4LC32	G4LC32ISA-LT	M4RTU
G4LC32SX	M4	SNAP-LCM4
G4LC32ISA	M4IO	SNAP-LCSX/PLUS

Status and Activity LEDs

Indicator	Description
TX0/RX0	Serial activity on port 0
TX1/RX1	Serial activity on port 1
TX2/RX2	Serial activity on port 2
TX3/RX3	Serial activity on port 3
STAT	Startup status and control program operational status
ACT	Ethernet network activity
LINK	Link established with Ethernet network

SNAP-PAC-S2-W Connectors and Indicators (Wired+Wireless)


Wireless LAN antenna
Serial activity LEDs
Activity LED (Yellow)
Link LED (Green)
Independent 10/100 Mbps Ethernet interfaces (RJ-45 connectors)
Ports 0 - 3 are each software configurable as either RS-232 (TX, RX, COM, DTR, DCD RTS, CTS), or RS-485 (2-wire, 4-wire, optional termination, optional biasing). Configure ports in PAC Manager.
Controller reset button
MicroSD card slot
WLAN LED
STAT LED
8–32 VDC input power (pluggable 3-pin connector)
Serial activity LEDs
SNAP PAC
OPTO 22
SNAP-PAC-S2-W
WLAN
STAT

RS-485 and RS-232 Ports[1]

Pin	RS-232	Signal Direction	RS-485	Signal Direction
1	TX	Out	TX/RX+	In/Out
2	RX	In	TX/RX–	In/Out
3	COM[2]		COM[2]	
4	RTS	Out	RX+ (4 wire)	In
5	CTS	In	RX- (4 wire)	In
6	DTR	Out	IRQ+	In
7	DCD	In	IRQ–	In

[1] **CAUTION**: **Do not use communication port connectors from a legacy OptoControl controller***. Legacy connectors will fit in a SNAP-PAC-S2, but the pin orientation is different. Instead, use the connectors supplied with the SNAP-PAC-S2 controller.

[2] Isolated ground. (Each channel is isolated from the others.)

*Legacy OptoControl Controllers:

G4LC32	G4LC32ISA-LT	M4RTU
G4LC32SX	M4	SNAP-LCM4
G4LC32ISA	M4IO	SNAP-LCSX/PLUS

Status and Activity LEDs

Indicator	Description
TX0/RX0	Serial activity on port 0
TX1/RX1	Serial activity on port 1
TX2/RX2	Serial activity on port 2
TX3/RX3	Serial activity on port 3
STAT	Startup status and control program operational status
ACT	Ethernet network activity
LINK	Link established with Ethernet network
WLAN	Wireless LAN status

B: PPP Support in Microsoft Windows

OPTO 22

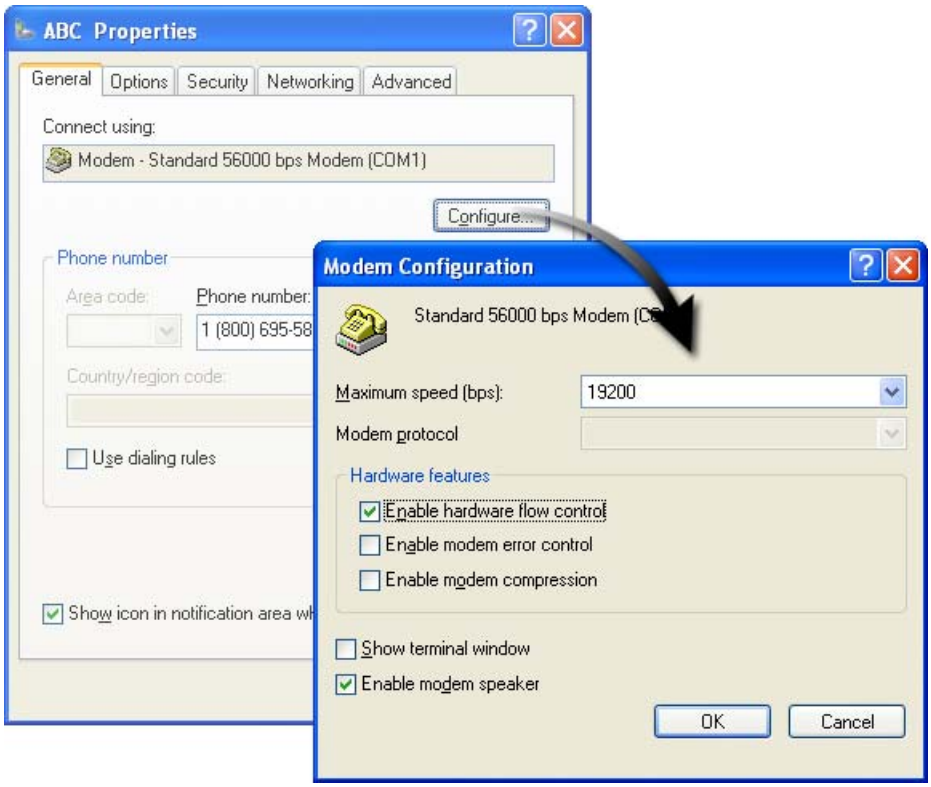
Configuring PPP Support in Microsoft Windows

Configuring Microsoft Windows Dial-up Networking on Windows XP

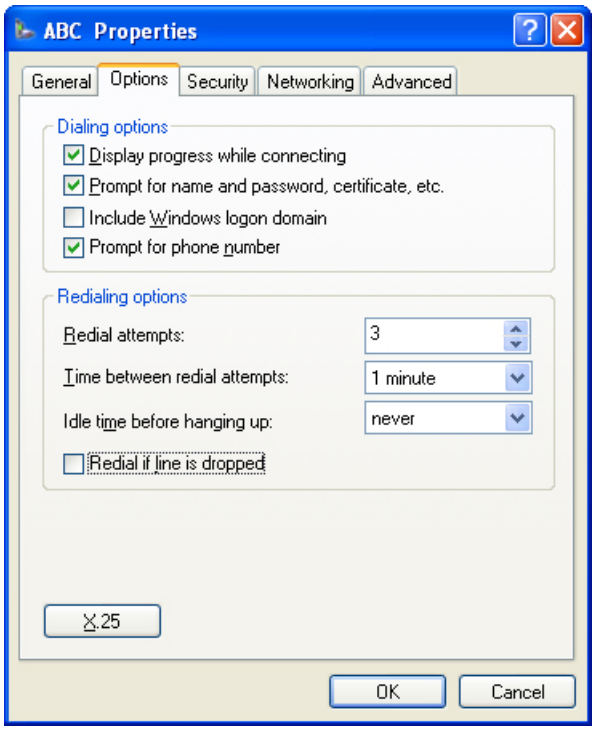
Use the following settings to configure Windows dial-up networking on any PC that will dial in to the controller.

1. Click Start→Control Panel.
2. Double-click Network Connections.
3. Under Network Tasks, click Create a new connection to display the New Connection Wizard.
4. Follow the directions in the wizard to create a new dial-up connection.
5. When the new connection is created, right-click its name in the Network Connections window and select Properties.
6. In the Properties dialog box, set each tab as shown in the following figures:

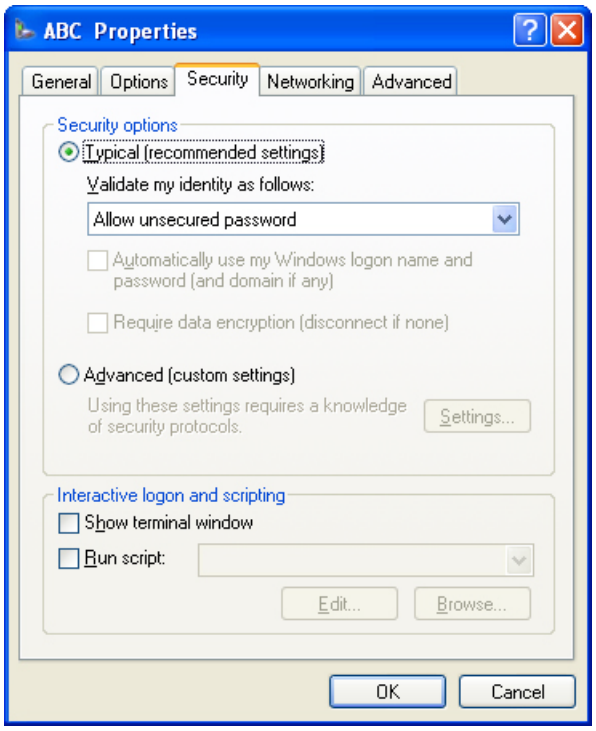
General Tab



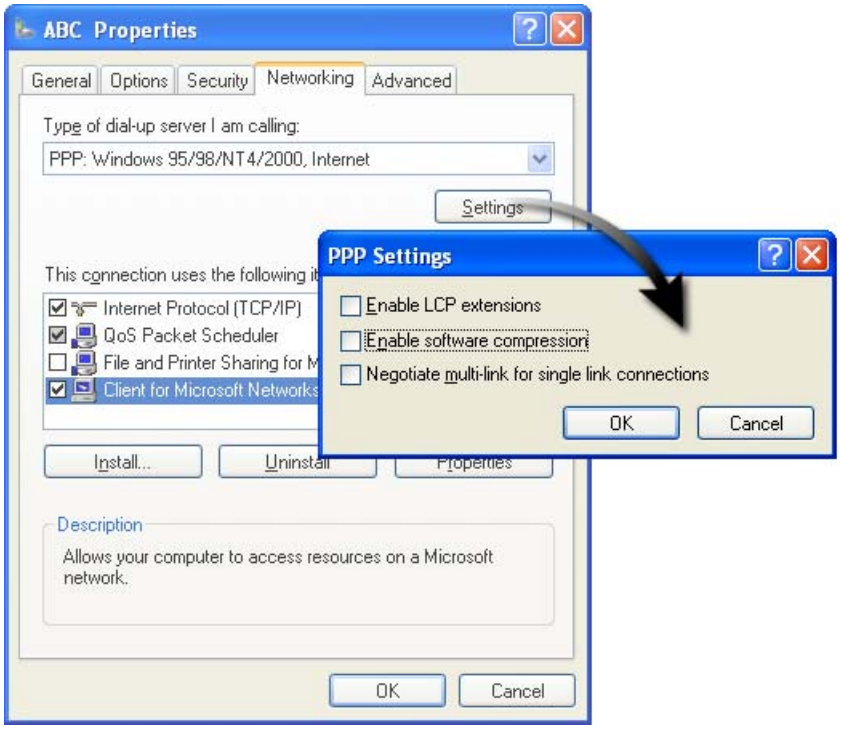
Options Tab



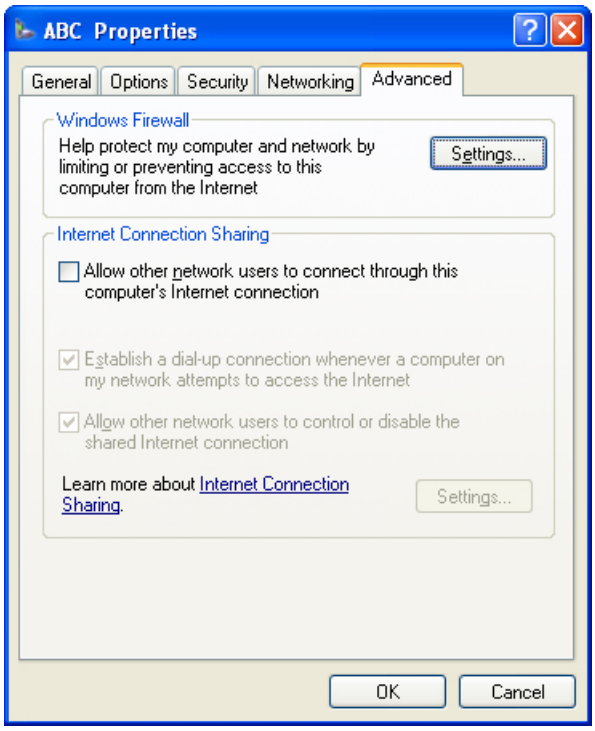
Security Tab



Networking Tab



Advanced Tab


ABC Properties
General
Options
Security
Networking
Advanced
Windows Firewall
Help protect my computer and network by limiting or preventing access to this computer from the Internet
Settings...
Internet Connection Sharing
Allow other network users to connect through this computer's Internet connection
Establish a dial-up connection whenever a computer on my network attempts to access the Internet
Allow other network users to control or disable the shared Internet connection
Learn more about Internet Connection Sharing.
Settings...
OK
Cancel

Configuring Microsoft Windows Dial-up Networking on Windows NT

Use the following settings to configure Windows dial-up networking on any PC that will dial in to the controller.

Click Start and choose Programs→Accessories→Dial-Up Networking.

Basic Tab

Phone Number—Enter the phone number for the modem attached to the controller. Some cellular services have a recorded voice message prior to connecting; if so, try appending an @ to the phone number. It should delay the modem modulation negotiation sequence long enough for the remote controller to pick up the line.

Server Tab

- Dial-up server type: PPP: Windows NT, Windows 95 Plus, Internet
- Network protocols: TCP/IP only
- Don't enable software compression
- Don't enable PPP LCP extensions
- TCP/IP Settings
  - Server assigned IP address
  - Server assigned name server addresses

- Don't use header compression
- Do use default gateway on remote network

Script Tab—After dialing: None

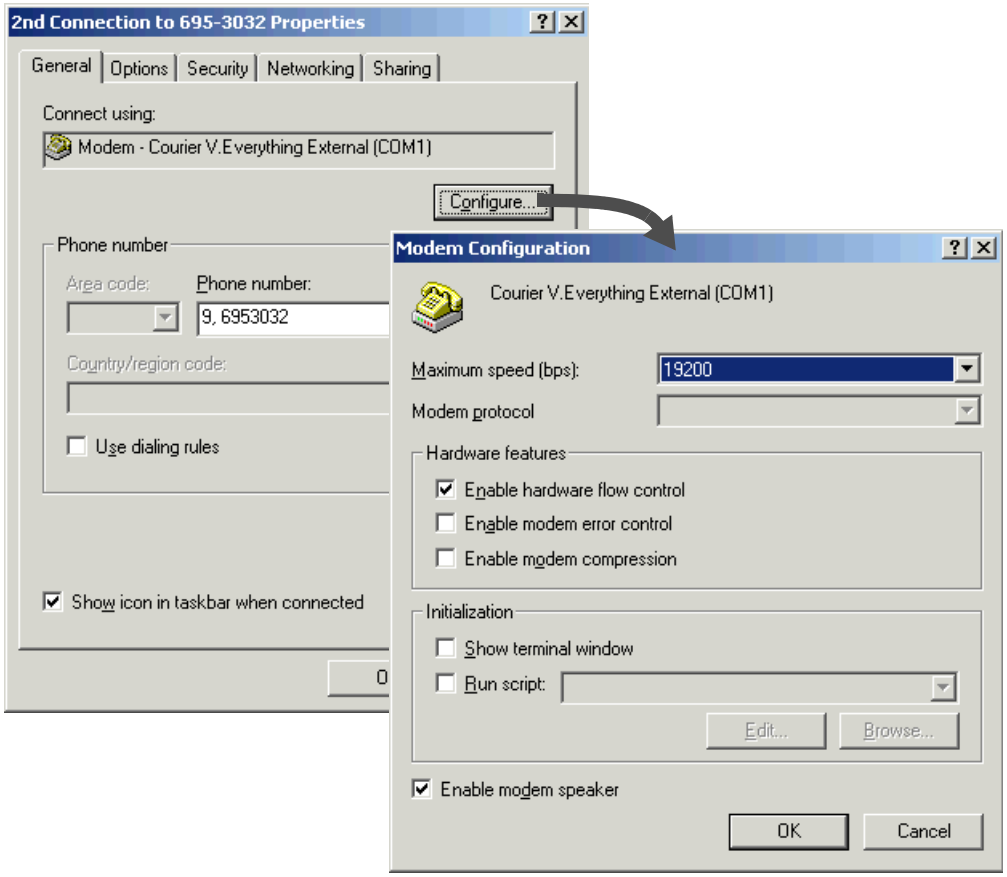
Security Tab—Accept any authentication including clear text.

Configuring Microsoft Windows Dial-up Networking on Windows 2000

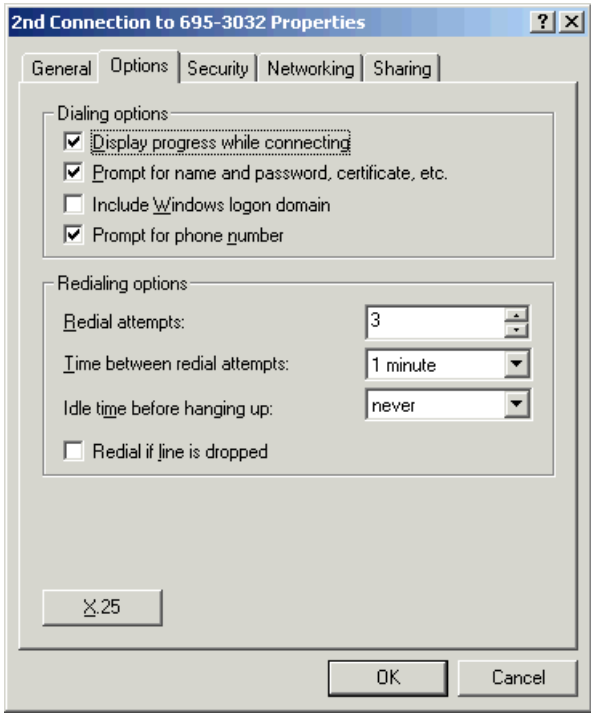
Use the following settings to configure Windows dial-up networking on any PC that will dial in to the controller.

1. Click Start and choose Settings→Control Panel. Double-click Network and Dial-Up Connections.
2. Double-click Make New Connection. Follow directions in the wizard to create a new connection.
3. When the new connection is created, double-click its name in the Network and Dial-Up Connections window.
4. In the Properties dialog box, set each tab as shown in the following figures:

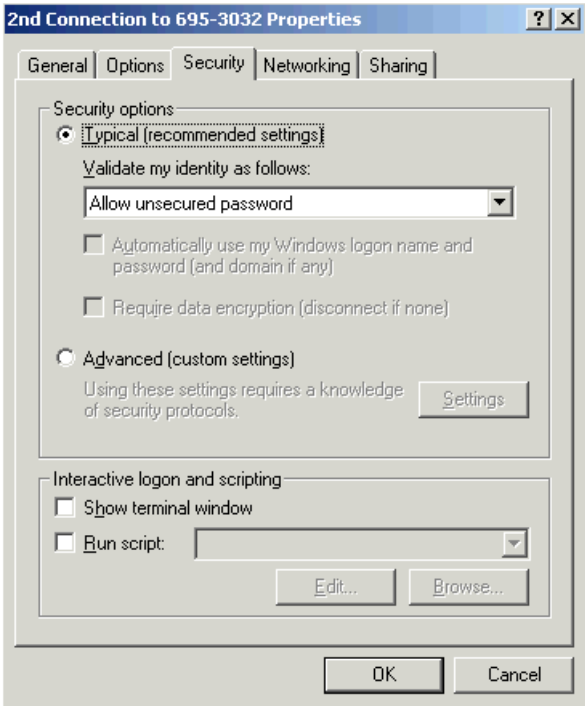
   General Tab



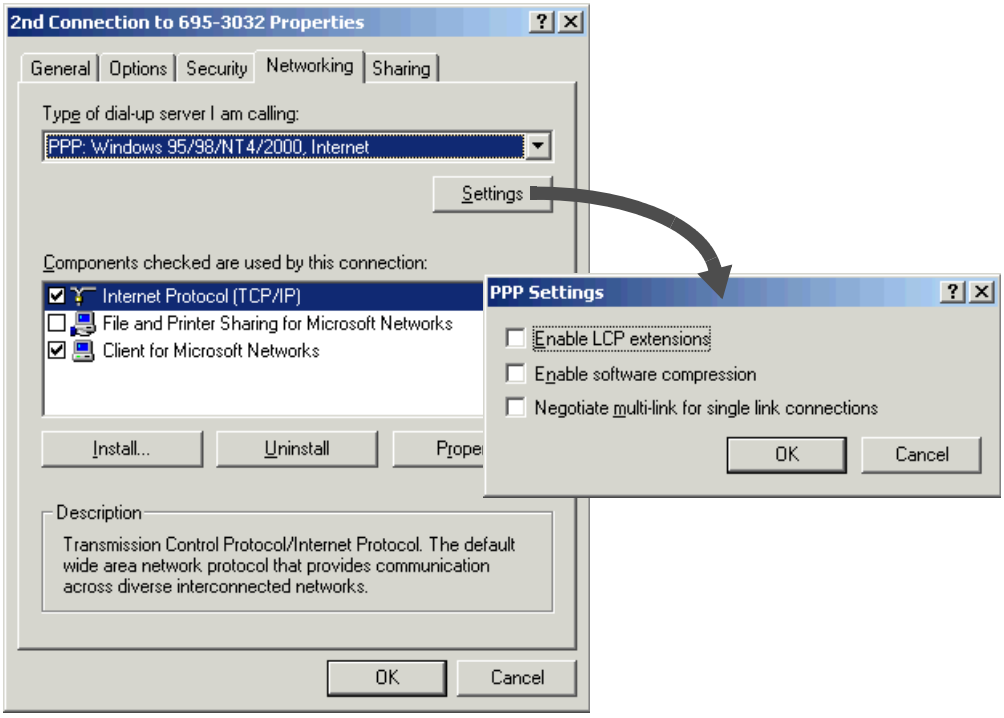
Options Tab



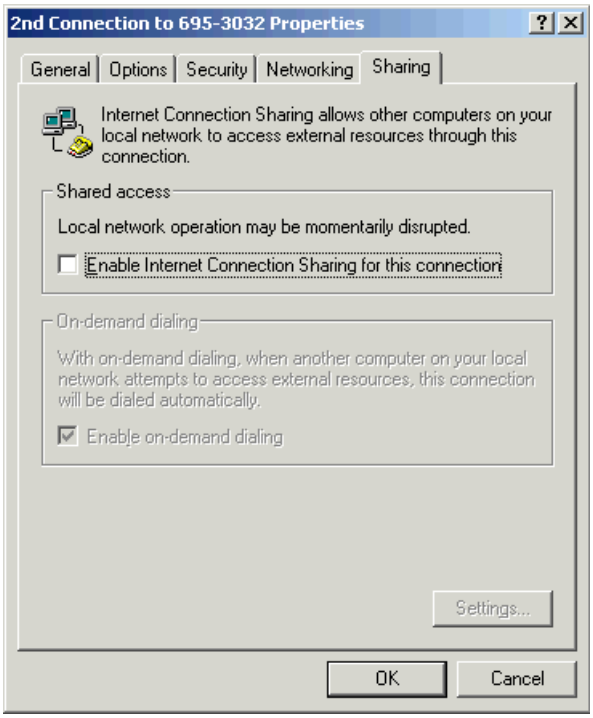
Security Tab



Networking Tab



Sharing Tab

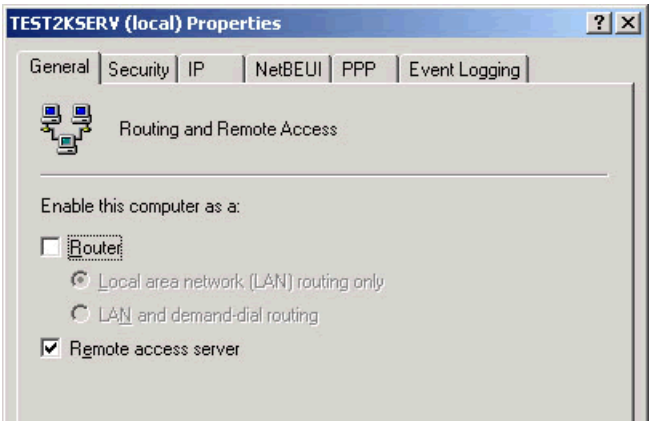

2nd Connection to 695-3032 Properties
General
Options
Security
Networking
Sharing
Internet Connection Sharing allows other computers on your local network to access external resources through this connection.
Shared access
Local network operation may be momentarily disrupted.
Enable Internet Connection Sharing for this connection
On-demand dialing
With on-demand dialing, when another computer on your local network attempts to access external resources, this connection will be dialed automatically.
Enable on-demand dialing
Settings...
OK
Cancel

Setting Up a Remote Access Server on the PC (Windows 2000 Advanced Server)

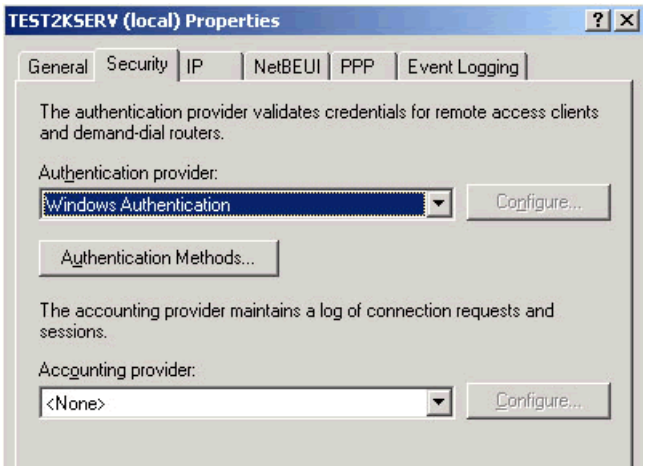
Use the following steps to set up a remote access server (RAS) on the PC so that the controller can dial in to the PC. Be sure to work closely with your System Administrator.

NOTE: Windows 2000 Professional does not support RAS; you need to have Windows 2000 Advanced Server.

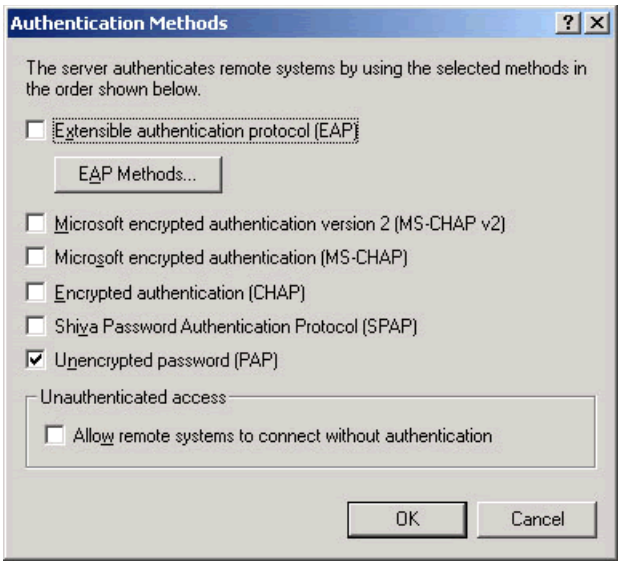
1. In Windows 2000, choose Start→Programs→Administrative Tools→Routing and Remote Access.
2. In the Action pull-down menu, select Add Server. Keep the default to add This Computer as the server. Click OK.
3. Right-click on the server you just added and choose Properties. Click the General tab and choose the following settings:



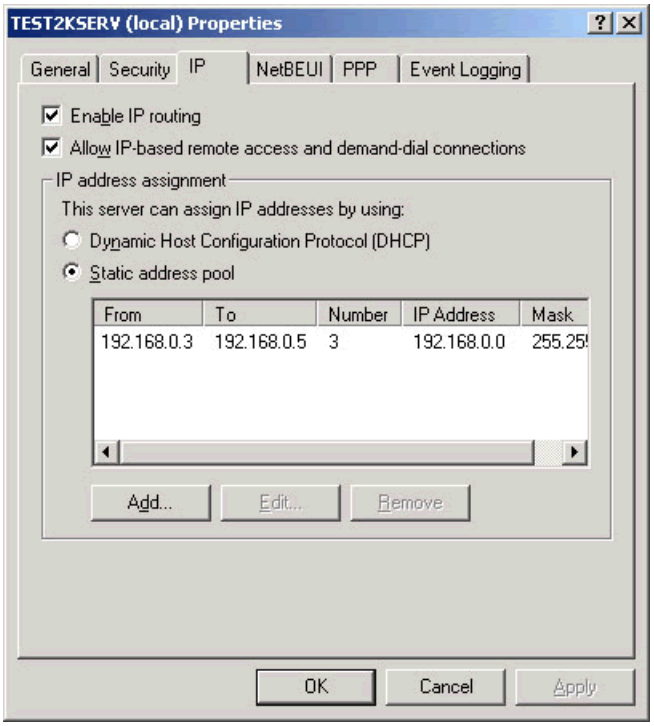
4. Click the Security tab and set as shown below:



5. Click the Authentication Methods button and set the following, and then click OK:

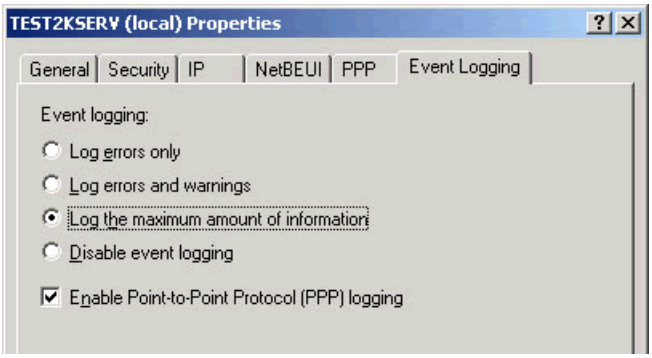

Authentication Methods
The server authenticates remote systems by using the selected methods in the order shown below.
Extensible authentication protocol (EAP)
EAP Methods...
Microsoft encrypted authentication version 2 (MS-CHAP v2)
Microsoft encrypted authentication (MS-CHAP)
Encrypted authentication (CHAP)
Shiva Password Authentication Protocol (SPAP)
Unencrypted password (PAP)
Unauthenticated access
Allow remote systems to connect without authentication
OK
Cancel

6. Set the IP tab to use either Static address pool or DHCP server. In this example, we used a Static address pool:



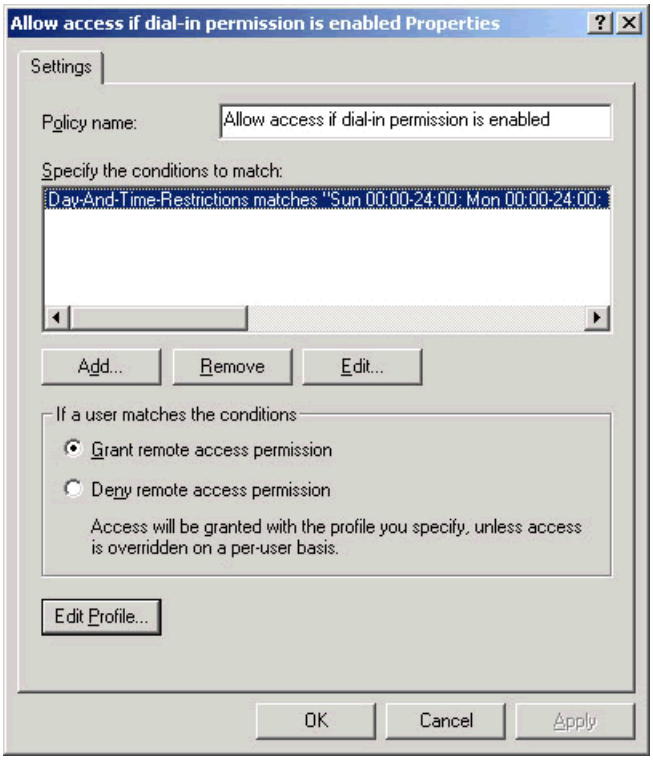
7. Click the PPP tab and make sure nothing is checked.

The NetBEUI and Event Logging tabs are not relevant to the controller's access. You can set them to any level you wish. Since event logging may be useful for troubleshooting the connection, you may want to set it as follows; but it is not required.



To see the log, use the Event Viewer in Administrative tools.

8. Once all tabs are set, click OK. Then highlight the Remote Access Policies branch of the tree. Double-click the only policy that appears in the window to the right. The following window should appear. Make sure that it is set to Grant remote access permission, as shown.


Allow access if dial-in permission is enabled Properties
Settings
Policy name:
Allow access if dial-in permission is enabled
Specify the conditions to match:
Day-And-Time-Restrictions matches "Sun 00:00-24:00; Mon 00:00-24:00;
Add...
Remove
Edit...
If a user matches the conditions
Grant remote access permission
Deny remote access permission
Access will be granted with the profile you specify, unless access is overridden on a per-user basis.
Edit Profile...
OK
Cancel
Apply

9. Click Edit Profile and click the Authentication tab. Be sure to uncheck everything except Unencrypted Authentication (PAP, SPAP).
10. Click the Encryption tab and set it to No Encryption.

11. Leave the Advanced, IP, and Multilink tabs at their default, which is to default to the server settings.

    The Dial-in Constraints permit you to set the server-side idle session timeout and max connect times. These settings are not required, but are useful in some cases.

12. Once all tabs are set, click OK, then click OK again.

    The RAS is now ready for the controller to dial in. Have your Network Administrator assign the controller a user name to use for dial-in permission.

Setting Up a Remote Access Server on the PC (Windows NT)

Use the following steps to set up a RAS on the PC so that the controller can dial in to the PC. Be sure to work closely with your System Administrator.

1. Click Start and choose Settings→Control Panel→Network.
2. Click the Services Tab, then click Add. Scroll down and highlight Remote Access Server. Click OK. Click Continue to copy necessary files.
3. In the Add RAS Device dialog box, choose your modem from the drop-down list or install it if it is not there. Click OK.
4. In the Remote Access Setup dialog box, click Configure. In the Configure Port Usage dialog box, choose either Receive calls only or Dial out and Receive calls. Click OK.
5. Back in the Remote Access Setup dialog box, click Network. Under Dial out and Server Settings, leave only TCP/IP selected. Click Accept any configuration including clear text. Click Configure.
6. In the RAS Server TCP/IP Configuration dialog box, do the following:
   - Check This computer only.
   - If you are using a DHCP server on your network, talk to your System Administrator about what addresses to assign. Otherwise, enter a Static PPP IP address pool for the controller (or other incoming devices) to use.
   - If you have configured the controller to Specify the local IP address when calling out, you must also check the box to allow remote clients to request a predetermined IP address.
   - Click OK and then click Continue.
7. (This step requires Administrator privileges on the PC.) Click Start and choose Programs→Administrative Tools→User Manager. From the User menu, choose New User. Create a new user and password that matches the login and password entered in PAC Manager when configuring PPP.
8. Still in the New User dialog box, click the Dialin button. Click Grant dialin permission to use, and leave No call back checked. Click OK.
9. When the new user and password are set, restart the PC.

   The RAS must be started so that the PC will listen for the controller's phone call. You can start it manually or set it to start automatically.

10. Click Start and choose Settings→Control Panel→Services. In the dialog box, scroll down and highlight Remote Access Server. To start the service manually, click Start. To set it to start automatically, click Configure and click Automatic Start.

RAS is ready for use.

Index

B

backup battery, 39, 51
bias and termination, PAC S1, 19
    switches, 53
brains supported, 3

C

compatibility
    brains, 3
    I/O units, 3
connectors
    PAC S1, 53
    PAC S1-W, 54
    PAC S2, 55
    PAC S2-W, 56

D

data
    microSD card, 41
dial-up networking
    on Windows 2000, 61
    on Windows NT, 60
    on Windows XP, 57
DIN-rail mounting, 25, 29, 30
    dimensions
        PAC S1, 29
        PAC S2, 30
DIP switches, PAC S1, 19, 53

E

environmental requirements, 51
Ethernet network, 1
    certification, 36
    errors, 35
    interfaces, 24, 53, 54
    troubleshooting, 35

F

Factory Mutual approval, 3
FactoryFloor, 4
files, in removable storage, 42
firmware
    booting from microSD card, 45
    disabling/enabling microSD updates, 48
    loading, 41
    updating from microSD card, 43

H

help
    network problems, 35
    troubleshooting, 33

I

I/O units supported, 3
indicators
    PAC S1, 53
    PAC S1-W, 54
    PAC S2, 55
    PAC S2-W, 56
interrupt line
    PAC S1, 22
    PAC S2, 22

IP address, assigning, 24

L

LEDs, 53, 54
    PAC S1, 53
    PAC S1-W, 54
    PAC S2, 55
    PAC S2-W, 56
legacy control hardware, 4
loading firmware, 41

M

memory, 51
memory map, 31
microSD card, 41
    booting from card, 45
    card type and format, 42
    disabling/enabling updates via card, 48
    storing data, 42
    updating firmware from card, 43
    updating strategy, 46
mode, termination, and bias, 19
modem, 10, 18, 57
mounting
    DIN-rail, 29
    panel, 25

N

network, 1
    basic diagram, 6
    certification, 36
    Ethernet errors, 35
    packet sniffer, 36
    redundant Ethernet links, 1, 11
    segmented, 1, 7, 8
    troubleshooting, 35
    wireless, 2, 8
network protocol analyzer, 36

O

OPC, 13
operating temperature, 51
OptoControl strategies, 4
OptoMMP Communication Toolkit, 31

P

PAC Control, 46
PAC Manager, 13, 19
PAC S1. See also SNAP-PAC-S1
PAC S2. See also SNAP-PAC-S2
packet sniffer, 36
panel mounting, 25
peer-to-peer communication, 31
pinouts
    PAC S1, 53
    PAC S1-W, 54
    PAC S2, 55
    PAC S2-W, 56
power requirements, 16, 51
power supply, 16
PPP communication, 3, 10, 12, 24, 57
processor, 51
product support, 14
PSTN, 3

R

redundant Ethernet links, 1, 11
remote access server (RAS)
    Windows 2000, 64
    Windows NT, 67
removable storage, 41
retransmit timeout (RTO), 36
RS-232, 3, 18, 24
RS-485, 3, 18, 24
RS-485, PAC S1
    bias and termination, 19

S

Scratch Pad, 31
sdcard0, 42
segmented network, 1, 7, 8
serial number, 16
serial ports, 3, 18
    PAC S1, 19
    PAC S2, 19, 20

assigning, 24
serial-based I/O units, 4, 9, 10
SNAP PAC SB-Series Brain, 21, 23
SNAP-PAC-S1
dimensions, 25
DIN-rail mounting and dimensions, 29
DIP switches, 19
interrupt line, 22
LEDs, 53, 54
mistic brain, connecting to, 22
panel mounting, 25
serial ports, 19
termination settings, 19
wiring, 19
wiring diagrams, 21
SNAP-PAC-S2
dimensions, 27
DIN-rail mounting and dimensions, 30
interrupt line, 22
LEDs, 55, 56
mistic brain, connecting to, 22
mode, termination, and bias, 19
panel mounting, 27
serial ports, 19, 20
wiring, 20
specifications, 51
storage temperature, 51
strategy, 46
disabling/enabling microSD updates, 48

T

TCP/IP
networks, 3
settings, 36
stack, 36
technical support, 14
temperature and humidity, 51
termination settings, SNAP-PAC-S1, 19
timeout, 36
troubleshooting, 33
network, 35

U

utilities, packet sniffer, 36

V

voltage range, 16

W

wired+wireless communication, 2
wireless LAN, 2
diagram, 8
specifications, 51
wiring
SNAP-PAC-S1, 19, 21
SNAP-PAC-S2, 20